HATCHERY SCIENTIFIC REVIEW GROUP

Puget Sound and Coastal Washington Hatchery Reform Project

A Scientific and Systematic Redesign of Hatcheries Programs to Help Recover Wild Salmon and Support Sustainable Fisheries

HATCHERY REFORM RECOMMENDATIONS

Skagit River Basin, Nooksack and Samish Rivers, Central Puget Sound

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❖ Introduction

The History of Hatcheries

There are approximately 100 hatchery facilities in Puget Sound and Coastal Washington operated by the Washington State Department of Fish and Wildlife (WDFW), Puget Sound and Coastal Indian Tribes and Nations, and the US Fish and Wildlife Service (USFWS). In operation for decades (some for over 100 years), these hatcheries were built for differing purposes ranging from mitigation for lost habitat, to creating a fishery where none existed previously, to meeting tribal trust responsibilities, to helping to conserve genetic diversity and rebuild struggling populations. Most hatcheries were built to produce fish for harvest, compensating for declines in naturally spawning salmon populations. Funding for these hatchery programs comes from a variety of sources, including federal, state, tribal, local and private sources.

Hatcheries are very important to the North Pacific sports and commercial fishing economy. In 1992, production for all species at Pacific Rim hatcheries totaled more than 5.5 billion fry, fingerlings and smolts released. More than 300 million eggs of all species are collected each year resulting in approximately 700,000 adult fish returning to Washington's hatcheries. In 1995, 157 million salmon and 8.9 million steelhead were released into Washington's waters. In the Hood Canal and Puget Sound areas, more than 88 million chinook, chum, coho, sockeye and pink salmon, and steelhead trout were released. Hatcheries provide over 80% of Washington's trout, over 90% of the inland catch of resident salmonids, 70% of the salmon harvested in Puget Sound, approximately 75% of all coho and chinook, and 96% of all steelhead harvested state-wide. Washington gets an annual direct benefit of over $850 million from recreational fishing (which ranks eighth nationally).[1]

Hatcheries also play an important role in meeting tribal treaty harvest obligations. Federal court rulings have affirmed tribal treaty harvest rights and established the tribes as co-managers of the salmon resource. These rulings have also affirmed that the tribal treaty right incorporates an environmental right, requiring state and federal governments to prevent salmon habitats from becoming degraded. In other words, state and federal governments must ensure that there are salmon available for the tribes to harvest. As wild salmon stocks declined over the years, tribal, state and federal governments became dependent on hatcheries to provide a meaningful level of harvest for Indian and non-Indian fishers.

A Need for Reform in the Face of Change

Although hatcheries have generally been successful at fulfilling this purpose of providing fish for harvest, our societal goals, priorities and circumstances have changed during the 100 years in which hatcheries have been in operation. A major change is currently taking place in the economics of fisheries. Aquaculture, including salmon farming, is growing rapidly and displacing commercial fishing as the source of food fish in many markets. Commercial fishers are having difficulty finding a market for their catch at a sustainable price. Hatcheries have an opportunity to improve their

[1] *Washington State Hatcheries (brochure);Washington Department of Fish and Wildlife September 1997 Final Environmental Impact Statement for the Wild Salmonid Policy; John Kerwin; Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, WA 98501.*

contribution to sustainable fisheries, but are hampered by a backlog of needed improvements to the facilities.

As better and more complete scientific information has become available, a more complex picture has emerged about the interrelationships between elements of an ecosystem. Hatchery production and facilities have been identified as one of the factors responsible for the depletion of naturally spawning salmon stocks. Some facilities have created stresses for naturally spawning fish, kept smolts from getting downstream and spawning fish from getting upstream, and lowered water quality. Physical and genetic interactions between naturally spawning and hatchery fish may have weakened natural stocks.

Population growth, urbanization and resource extraction have led to a continued loss of habitat and a decline of naturally spawning salmon. This has led to different management goals and objectives, including conservation goals. Producing fish for harvest can no longer be the sole purpose of hatcheries.

Several Puget Sound and Coastal salmon and steelhead stocks are listed or proposed for listing under the federal Endangered Species Act (ESA). As part of a larger recovery process, state, tribal and federal managers of Washington's salmon and steelhead must ensure that their hatcheries do not present a risk to listed species. There is also an opportunity for hatcheries to provide benefits to the recovery process, in addition to providing harvest, educational and cultural benefits.

Fortunately, hatchery management is ripe for the change necessary to respond to these new priorities. The state and tribal "co-management" regime that was created in the mid-1980s to resolve decades of hostility and conflict is now well-established, allowing for modification and progress. Leadership at the corresponding agencies is stable, strong and creative. Whereas hatchery management decisions have often been piecemeal in the past, the managers are now turning to a system-wide outlook. Instead of the more traditional, bureaucratic approach of operational management, the new focus is on management by objectives, with feedback mechanisms that allow for adaptation and improvement.

The Hatchery Reform Project: A Scientific Approach to Hatchery Management

In 1999, a group of leading scientists presented its recommendations to the US Congress in a report entitled *The Reform of Salmon and Steelhead Hatcheries in Puget Sound and Coastal Washington to Recover Natural Stocks While Providing Fisheries*. The report determined that the potential exists for hatcheries to have a major positive impact on the recovery of naturally spawning salmon, in just a few years and at relatively small costs. The team called for a comprehensive hatchery reform effort, led by a panel of independent scientists, to conserve indigenous genetic resources; assist with the recovery of naturally spawning populations; provide for sustainable fisheries; conduct scientific research; and improve the quality and cost-effectiveness of hatchery programs.

Congress adopted and funded the recommendations in fiscal year 2000, launching the Puget Sound and Coastal Washington Hatchery Reform Project. The project is a systematic, science-driven redesign of how hatcheries can be used to achieve new purposes:

1) helping to recover and conserve naturally spawning populations; and
2) supporting sustainable fisheries.

The appropriations language provided funding to:

- Establish an independent scientific panel to ensure a scientific foundation for hatchery reform;
- Provide a competitive grant program for needed research on hatchery impacts;
- Support state and tribal efforts to implement new hatchery reforms; and
- Provide for the facilitation of a reform strategy by an independent third party.

The Hatchery Reform Project provides the vehicle the managers need to manage changes in the hatchery system, by examining hatcheries scientifically, in the context of their watersheds and ecosystems. A panel of independent scientists has been made available to evaluate the risks and benefits of hatchery programs, and to synthesize the options available, allowing the managers to make informed decisions in the face of uncertainty.

Elements of a Successful Hatchery Reform Effort

SUPPORT FROM ELECTED AND APPOINTED OFFICIALS

Many factors have come together to create this opportunity to reform hatchery practices and improve the contribution from hatcheries to salmon conservation and sustainable fisheries. As mentioned above, an important factor has been the support of strong and creative leaders at the fisheries management agencies. Just as important has been the backing of federal, state, tribal and local elected officials. The project has received bipartisan support from many regional leaders, including:

- Representative Norm Dicks (D-WA)
- Washington Governor Gary Locke
- U.S. Senator Patty Murray (D-WA)
- Former U.S. Senator Slade Gorton
- Representative Jennifer Dunn (R-WA)
- Northwest Indian Fisheries Commission (NWIFC) Chair Billy Frank, Jr.
- WDFW Director Jeff Koenings
- Washington State Salmon Recovery Funding Board Chair William Ruckelshaus

INDEPENDENT SCIENCE: THE HATCHERY SCIENTIFIC REVIEW GROUP

The Hatchery Scientific Review Group (Scientific Group) is the independent scientific panel established and funded by Congress to provide an autonomous and credible evaluation of hatchery reform programs in Puget Sound and Coastal Washington. The objective of the Scientific Group is to assemble, organize and apply the best available scientific information to provide guidance to policy makers who are implementing hatchery reform.

The Scientific Group is composed of five independent scientists (selected from a pool of candidates nominated by the American Fisheries Society) and four agency scientists designated by WDFW, NWIFC, the National Oceanic and Atmospheric Administration Fisheries/National Marine Fisheries Service (NMFS) and USFWS. Like the independent scientists, the agency scientists are responsible for evaluating scientific merits and are not to represent agency policies. They are a valuable minority complement to the independent scientists' majority, in that they have detailed knowledge of, and history with, agency hatchery programs and personnel. The mixture has created a group that is not only independent and focused on science, but also practical and pragmatic. The nine scientists serving

on the Scientific Group have a broad range of experience. Their scientific disciplines range from biology, genetics, ecology, fisheries, fish culture, fish pathology, and biometrics to other disciplines. Members include:

- John Barr, NWIFC (Vice Chair)
- Lee Blankenship, Northwest Marine Technology (Vice Chair)
- Donald Campton, PhD, USFWS
- Trevor Evelyn, PhD, retired, Department of Fisheries and Oceans Canada
- Conrad Mahnken, PhD, NMFS Manchester
- Lars Mobrand, PhD, Mobrand Biometrics (Chair)
- Lisa Seeb, PhD, Alaska Department of Fish and Game
- Paul Seidel, WDFW
- William Smoker, PhD, University of Alaska

POLICY-LEVEL INVOLVEMENT: THE HATCHERY REFORM COORDINATING COMMITTEE

The managers have established a Hatchery Reform Coordinating Committee (Coordinating Committee) as a vehicle for cooperative management on this reform effort. The purpose of the committee is to ensure a successful working relationship between the Scientific Group, management decision-makers and their own hatchery reform science teams and other staff. The Coordinating Committee's immediate adoption of the project's twin goals was an important early sign of leadership and of their commitment to the process and the role of the Scientific Group. The Committee's establishment recognizes and respects the co-manager relationship. It provides a venue for "ground-truthing" Scientific Group plans and products, and implementing hatchery reform at the policy level.

Committee members include Billy Frank and Jim Anderson, NWIFC; David Troutt, Nisqually Tribe; Jeff Koenings and Larry Peck, WDFW; Dan Diggs and Chuck Dunn, USFWS; Bob Lohn and Rob Jones, NMFS; Pete Bergman, Frank Haw and Terry Wright, former Congressional Hatchery Science Advisory Team; and Barbara Cairns, Long Live the Kings.

PROJECT MANAGEMENT, FACILITATION AND COMMUNICATIONS

One aspect of the Hatchery Reform Project that makes it distinct from most other processes that endeavor to make independent science central to a policy-making process is that the Congressional authorizing language stipulated that a non-governmental organization be involved, to provide third-party project management, facilitation and communications. The third party facilitator specified by Congress is Long Live the Kings (LLTK), a private, non-profit organization whose mission is to restore wild salmon to the waters of the Pacific Northwest. LLTK's role includes providing facilitation and project management to the Scientific Group and the Coordinating Committee; and helping the managers communicate hatchery reform progress to Congress, state legislators, stakeholder groups and the public. LLTK retained Gordon, Thomas, Honeywell to serve on the facilitation team.

MANAGING CHANGE COOPERATIVELY: THE "FOUR-LEGGED STOOL"

This "four-legged stool" of political support, independent science, coordination by managers, and third-party project management has proven to be a highly-effective formula. It provides for a clear

understanding of roles, letting the scientists be scientists and the managers be managers. The facilitation team provides "cross-walks" and communicates progress to stakeholders and the public. The Scientific Group can focus on providing scientific guidance to policy makers, rather than trying to tell the managers what to do. The process is not prescriptive. The scientific recommendations assess benefits and risks, but leave the "how-to's" to managers. It is the managers' responsibility to evaluate the recommendations and make decisions on implementation.

The Scientific Group and LLTK are responsible for reporting to Congress on progress made in implementing hatchery reforms. In addition, in order to fulfill its role as the project's communications vehicle, LLTK must ask questions the managers need to answer to demonstrate to skeptics that the approach is scientific, transparent, measurable and comprehensive. The result is a level of introspection and creativity not common to governmental processes.

REGIONAL REVIEW PROCESS

Early in the process, the Scientific Group and Coordinating Committee agreed that it is important to evaluate hatchery programs in the context of the watersheds in which they operate and the goals set for them by the managers. For this reason, they divided Puget Sound and the coast into ten regions, providing an opportunity to make region-by-region recommendations based on: 1) regional management goals for conservation, harvest and other purposes; 2) stock status (biological significance and population viability); 3) habitat status (current and future); and 4) the particulars of each hatchery program. These ten regions include:

- Eastern Strait of Juan de Fuca
- South Puget Sound
- Stillaguamish/Snohomish Rivers
- Skagit River Basin
- Nooksack/Samish Rivers
- Central Puget Sound
- Hood Canal
- Willapa Bay
- North Coast
- Grays Harbor

These reviews are conducted via in-region meetings, with the involvement of regional fisheries and habitat managers and other interested parties, and are supported by a collaborative information gathering and sharing process among the management agencies and the scientists. Steps in the process include: 1) informal introductory meetings; 2) a regional briefing book that allows the managers to describe their goals and operations for each hatchery program; 3) field tours with interaction between the scientists and hatchery managers; 4) meetings where the regional participants "truth" the regional goals that have been provided to the Scientific Group for each stock and the purposes/types of programs; 5) opportunities for the regional participants to state what issues they feel need to be addressed during the review; 6) face-to-face conversations on operations; and 7) an informal, oral review of the Scientific Group's preliminary recommendations.

SCIENTIFIC TOOLS FOR REVIEWING HATCHERY PROGRAMS

In the project's first year, the Scientific Group developed a number of tools to assist with the reviews and for the managers' use. These tools have been essential to the project's methodical and scientific review of hatchery programs. A companion document to this report, entitled *HSRG Scientific Framework and Hatchery Review Program,* provides the Scientific Group's full set of review tools and a description of the regional review process used to apply them, in order to create hatchery reform recommendations. It also provides more detail on the terms and concepts in this report.

Scientific Framework for Artificial Propagation of Salmon and Steelhead

The Scientific Framework underlies and informs all of the Scientific Group's tools, processes and recommendations. It provides a scientific foundation for hatchery reform and is organized around five key areas where hatcheries must be successful in order to meet the twin goals for hatchery reform: 1) Hatcheries in the Ecosystem Context: The Regional Approach; 2) Hatcheries in the Populations/ Species Context; 3) Effects of Hatchery Operations on Harvest and Conservation of the Target Stock; 4) Effects of Hatchery Fish on Harvest and Conservation of Other Stocks and Species; and 5) Accountability for Performance at Hatcheries. The Framework was first published in December 2000, after review by over 200 scientists and stakeholders, and before the rest of the review tools were developed and the regional review process began.

Research Program

The ability to effectively achieve hatchery reform goals is compromised by lack of scientific certainty on many subjects. To reduce this uncertainty, the Scientific Group has awarded over $1.5 million in a competitive grant program to research projects that are helping to answer questions such as how to reduce harvest on wild fish, how to avoid adverse genetic effects of hatchery fish on wild stocks, how to avoid adverse ecological interactions, how to improve hatchery practices, and how to monitor and measure success. Grantees have reported back to the Scientific Group at annual research review meetings and they are making good progress. But there are many questions left to answer and a number of projects that will take more time to bear scientific fruit.

Emerging Issues in Hatchery Reform

The Scientific Group decided that significant revisions to the Scientific Framework should begin as issue papers authored by individual members, task teams or the Scientific Group as a whole. These papers can be as simple as a few paragraphs or as detailed as an essay for a peer-reviewed journal. They are incorporated into the Framework once they have been reviewed and refined.

Benefit/Risk Tool

This tool was adapted and simplified from a tool developed by the co-managers.[2] It allows the Scientific Group and the managers to evaluate the relative benefits and risks associated with specific actions and choices in hatchery management—in a scientifically sound, methodical manner.

Operational Guidelines

The Scientific Group has developed a set of operational procedures consistent with the Scientific Framework, to address ecological effects, genetic integrity and fish health concerns, and to provide new guidelines for fish rearing and accountability for success.

Monitoring and Evaluation Criteria

These provide criteria upon which to determine the success of a hatchery program. Every facility has the potential to be a scientific research station. These criteria provide a blueprint for how to collect and evaluate data relating to the health of out-migrating smolts, stray rates of returning adults, whether or not hatchery rearing has affected fish size and run timing, and other factors.

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[2]. *Draft Benefit-Risk Assessment Procedure (BRAP) for Washington State Department of Fish and Wildlife Artificial Propagation Programs, November 17, 2000.*

AGENCY SCIENCE TEAMS

The congressional funding dedicated to supporting state and tribal efforts to implement new hatchery reforms has been used to establish agency science teams. These teams have undertaken a variety of activities that support the hatchery reform process. One of the most important of these has been helping the facilitation team acquire, assemble and make available to the Scientific Group regional briefing information about the hatcheries and the ecosystems in which they operate. This ensures that the Scientific Group is making its evaluations and recommendations based on the same data as the co-managers use to establish their goals and programs.

Other valuable functions being provided by the agency science teams include conducting risk analysis on hatchery programs to meet hatchery ESA requirements; conducting and overseeing agency research on hatchery effects and practices that complements the Scientific Group's research grant program; coordinating the implementation of early reforms; reporting agency activities for Congressional reports; acting as messengers and points of contacts for the project within the agencies; interpreting technical literature for hatchery managers; and otherwise providing technical support to the Scientific Group, the Coordinating Committee, and the regional staff that are participating in the review process.

DRAFT RECOMMENDATIONS PROVIDED TO MANAGERS

A final element that has proven to be important to the project's success is the Scientific Group's decision to provide their draft recommendations to the managers for review, before final recommendations are published. The intent is to give the managers an opportunity to note factual errors, clear up misunderstandings, provide new information and comment on how the recommendations are described. The scientific content of the recommendations does not change. For each set of recommendations, there is also a section for the managers of each hatchery program to insert their concise response to the recommendations, including implementation plans. This is important for confirming the managers' commitment to implementing reforms, and for demonstrating this commitment to the elected officials who must decide whether or not to fund the reforms.

Hatchery Reform Recommendations

This report provides the recommendations developed by the Scientific Group upon reviewing three regions during 2002—the Skagit River Basin, the Nooksack and Samish rivers, and Central Puget Sound. Also included are Area-Wide Recommendations, reform measures that apply across the entire Puget Sound and Coastal Washington area. This report follows a similar one released in February 2002 that provided recommendations for the three regions reviewed by the Scientific Group during 2001—the Eastern Strait of Juan de Fuca, South Puget Sound, and the Stillaguamish and Snohomish rivers. The remaining four regions (Hood Canal, Willapa Bay, North Coast, and Grays Harbor) will be reviewed in 2003, with a report released subsequently adding recommendations for those regions.

These recommendations argue for a new, systemic, scientific approach to hatchery management. The recommendations that come from this process will help the managers prioritize limited implementation dollars and make their case to Congress, the legislature and private funders for financial support. The recommendations will provide hatchery managers with a blueprint for change.

COMPONENTS OF THIS REPORT

Area-Wide Recommendations

This report begins with a chapter of Area-Wide Recommendations, reform measures that apply to the entire Puget Sound and Coastal Washington area. These have been revised since last year's report, with several new Area-Wide Recommendations having been added.

Regional Reviews

Following the Area-Wide Recommendations are chapters for each of the regions reviewed in 2002. Each of these chapters begins with a general overview of the region and/or its identified sub-regions, a table containing ratings for all salmonid stocks in that region (as provided by the managers), then reviews and recommendations for each salmonid stock that has an associated hatchery program.

Program Recommendations

Each individual salmonid stock program review and recommendations section begins with a listing of the managing agency(s) and/or tribe and a table that provides the current, short-term (10–12 year) and long-term (50 year) stock goals and associated hatchery program purpose and type, as they were expressed to the Scientific Group by the managers during the regional review process (see example below). Following the example table are definitions of each rating included in the table.

Stock Goals:	**Current**	**Short-Term**	**Long-Term**
Biological Significance	High	High	High
Population Viability	Critical	Critical	At Risk
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	None	None	Occasional
Hatchery Program:			
Purpose	Conservation		
Type	Integrated		

Biological significance is determined by considering a number of specific factors relating to stock origin, biological attributes and population subdivisions (see *HSRG Scientific Framework and Hatchery Review Program* for more detail), with the stock defined as being of either *low*, *intermediate* or *high* significance.

Population viability is also determined by considering a number of specific factors such as age class structure, spawner escapement and proportion of hatchery-origin fish in natural spawning (see *HSRG Scientific Framework and Hatchery Review Program* for more detail), with the stock's viability defined as being either *critical*, *at risk* or *healthy*. This rating refers to the stock's ability to sustain itself in the natural environment (except in the case of a segregated harvest program, in which case the ratings are *low*, *medium* and *high* and refer to the stock's ability to sustain itself in the culture environment).

The stock's spawning, freshwater, migration and estuarine **habitat** is rated as either *inadequate* (target stock is unproductive and the population will go extinct, even without terminal harvest), *limiting* (target stock is productive enough for the population to sustain itself at a low level terminal

harvest) or *healthy* (productivity of the stock is high and the population is capable of growth and supporting significant terminal harvest).

Harvest opportunity is rated according to whether the goal is to provide *no* directed harvest opportunity, *occasional* opportunity, opportunity *most years*, or opportunity *each year*.

The **purpose** of the hatchery program is defined as either *conservation*, *harvest*, *both* and/or another purpose (such as *education*, *research* or *cultural/ceremonial*).

The **type** of program is also included. Hatchery programs are classified as *integrated* if the goal is to minimize potential genetic divergence between the hatchery broodstock and the naturally-spawning population in the watershed where fish are released and returning adults trapped for broodstock. *Segregated* programs are classified as those in which the goal is to maintain the hatchery population as a distinct, or genetically segregated, population.[3]

Following this table, each stock review and recommendations section includes: 1) the Program Description as provided by the managers, including Genetic Diversity Unit (GDU) information,[4] 2) Operational Considerations (elements recognized by the Scientific Group in considering the way the program is currently being operated), 3) the Benefits and Risks being conferred by the program on the target stock and other regional stocks, 4) the Recommendations from considering benefits and risks, 5) a section for other Comments on the program from the Scientific Group, and 6) a section for a Response to the review and recommendations from the relevant management agency(s) and/or tribes.

This report focuses primarily on issues that need to be addressed and recommends changes that need to be made. It should not be read as a complete review listing every positive attribute alongside those that need to be changed. After reviewing over 100 programs in six regions, the Scientific Group has been very impressed by the diligence—and frequently the ingenuity—with which the state and tribal staffs carry out their programs; and with their dedication to the resource.

It is important to note that the recommendations contained in this document are based upon current goals and the best scientific information available at the time the reviews were conducted. In keeping with the tenets of adaptive management, [5] it will be necessary to review and adapt these

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[3] *See HSRG Area-Wide Recommendation on operating integrated and segregated hatchery programs.*

[4] *A genetic diversity unit (GDU) is a group of genetically similar stocks that is genetically distinct from other such groups. The stocks typically exhibit similar life histories and occupy ecologically, geographically, and geologically similar habitats. Information about GDUs and broodstock origin included in these program descriptions provided by Washington State Department of Fish and Wildlife staff; GDU information is based on Busack, C. and J. B. Shaklee. 1995. Genetic Diversity Units and Major Ancestral Lineages of Salmonid Fishes in Washington. Washington State Department of Fish and Wildlife, Technical Report #RAD 95-02. A table listing all Puget Sound and Coastal Washington GDUs is included as an appendix to this report.*

[5] *See HSRG Scientific Framework and Hatchery Review Program, chapter on Emerging Issues in Hatchery Management, for a discussion on adaptive management.*

recommendations as new scientific information arises and/or goals change. This and all other Hatchery Reform Project-related publications are available from the project's web site (www.lltk.org/hatcheryreform.html) or by contacting Long Live the Kings at (206) 382-9555.

❖Area-Wide Recommendations

Take a Regional Approach to Managing Hatchery Programs

The Scientific Group and the managers agreed that it is important to evaluate hatchery programs in the context of the regions and watersheds in which they operate and the goals set for them by the managers. Having reviewed six regions, the Scientific Group has determined that this approach is not only important, but vital to the success of the process. This same regional approach will be essential to the implementation of hatchery reform. This will obviously take a high degree of coordination between and among managers. Experience to date indicates that the regions selected for this process are appropriate, in that they are based on geography, drainages, stock assemblages and shared goals. The Scientific Group recommends that implementation be coordinated by regional technical groups, either those currently in existence or ones patterned on the regional participant lists generated for the review process.

Operate Hatcheries within the Context of Their Ecosystems

The benefits and risks of hatcheries can only be properly evaluated in the context of their ecosystems. The current and future status of these ecosystems, including the status of naturally spawning stocks and the environment, will determine the potential for success and the limitations on any hatchery program.

Measure Success in Terms of Contribution to Harvest, Conservation and Other Goals

In the past, hatchery programs have too often been evaluated on the basis of the number of fish released. This is akin to evaluating a farm by the number of seeds planted. More appropriate measures of success include fish quality (see below), harvest opportunity and adults returning to reproduce and sustain the stock. In the future, hatcheries may also be evaluated on the basis of their socio-economic benefits and their contribution to the ecosystem as a whole. Examples include educational and research opportunities, cultural/ceremonial purposes, for food banks and institutions, and watershed nutrification.[6]

Emphasize Quality, Not Quantity, in Fish Releases

The Scientific Group's working model is that the best a hatchery program can expect to do is to match a wild salmonid template in terms of the physiological, morphological and behavioral traits that affect smolt-to-adult performance. It is important that some measure of the quality, rather than simply the quantity, of fish released from hatcheries be measured and evaluated in a regional context. The Scientific Group is preparing a paper addressing this issue.[7]

Operate Hatchery Programs as either Genetically Integrated or Segregated Relative to Naturally-Spawning Populations[8]

Hatchery programs can be classified as either *integrated* or *segregated*, depending on the genetic

[6] *See HSRG Scientific Framework and Hatchery Review Program, Emerging Issues chapter, section on ecological significance.*

[7] *See HSRG Scientific Framework and Hatchery Review Program, Emerging Issues chapter, section on smolt quality.*

[8] *See HSRG Scientific Framework and Hatchery Review Program, Emerging Issues chapter, section on integrated and segregated programs.*

management goal for the broodstock. Hatchery programs are classified as integrated if a principal goal is to manage the broodstock as an artificially propagated component of a naturally spawning population. In contrast, hatchery programs are classified as segregated if the management goal is to propagate the hatchery broodstock as a discrete or genetically segregated population, relative to naturally spawning populations.

A fundamental goal of an integrated program is to minimize genetic divergence between the hatchery broodstock and a naturally spawning population, in areas where fish are released and/or collected for broodstock. The long-term goal is to maintain genetic characteristics of a local, natural population among hatchery-origin fish, by minimizing genetic changes resulting from artificial propagation and potential domestication. In an idealized integrated program, natural-origin and hatchery-origin fish are genetically equal components of a common gene pool. A hatchery supporting an integrated program can be viewed conceptually as an artificial extension of the natural environment, where the population as a whole (hatchery plus wild) is sustained at a much higher level of abundance than would occur without the hatchery. A properly-managed integrated broodstock can potentially serve as a genetic repository, in the event of a major decline in the abundance of natural-origin fish.

An integrated program does not imply that natural spawning of hatchery-origin fish is desired or even occurs. Natural spawning (a.k.a., supplementation) relates to the purpose, desired benefits and potential risks of a hatchery program, and not to the genetic management goals for a broodstock, although the two sets of goals are usually correlated. Hatchery-origin fish spawning naturally does not make a hatchery broodstock genetically integrated—only if natural-origin fish are included in the broodstock can the broodstock be considered "integrated." In this context, the management goal of an integrated program is to maintain the genetic characteristics of "wild" fish among hatchery-origin fish, not vice-versa.

Specific recommendations for integrated programs include:

- Include natural-origin fish in the hatchery broodstock so that an annual average of 10–20% of the broodstock is composed of natural-origin adults from the watershed where adults are collected for broodstock.
- Collect and spawn adults randomly with respect to time of return, time of spawning, size, and related characteristics.
- Impose hatchery management practices that minimize the potential domestication effects of the hatchery environment.
- Monitor and control natural spawning by hatchery-origin adults so that they constitute, at most, one-third of the natural spawners within a stream or watershed.

The fundamental goal of a segregated program is to propagate the hatchery broodstock as a discrete population or gene pool that is segregated, genetically and reproductively, from naturally spawning populations. Once established, segregated broodstocks are composed almost entirely of hatchery-origin adult returns. As a consequence, genetically-segregated hatchery populations can, and will, change genetically, relative to naturally spawning populations. Such changes can be intentional to maximize the desired benefits of the program, while minimizing risks to naturally spawning populations. However, in contrast to integrated programs, any natural spawning by hatchery-origin fish from a segregated program will impose potentially unacceptable risks to natural populations.

Specific recommendations for segregated programs include:

- Release fish in areas where opportunities to capture non-harvested adults are maximized, thus minimizing genetic risks to natural populations.
- Release fish in a manner and/or at a location that minimizes potential straying and opportunities for natural spawning.
- Ensure hatchery-origin adults constitute no more than one to five percent of natural spawners.
- Mark all released hatchery-origin fish to maximize potential harvest, and to assess stray rates and genetic risks to naturally spawning populations.
- Avoid trapping natural-origin adults, and exclude them from the broodstock.

Every hatchery program must be identified as either integrated or segregated, with operational procedures designed to achieve the specific goals for one of those two types of programs. In this context, "intermediate" programs cannot exist without potentially posing unacceptable risks to natural populations.

Size Hatchery Programs Consistent with Stock Goals

Fisheries managers should determine the proper size (number of fish released) of a hatchery program based on their goals for the stock. Integrated harvest programs should be sized consistent with the productivity of the natural population and the capacity of the habitat to support that population, while addressing long-term habitat preservation and improvement. An integrated harvest program will be successful only if the habitat is capable of sustaining the naturally produced component of the population at a level consistent with guidelines for the proportions of natural and hatchery fish on the spawning grounds and in the hatchery broodstock. Conservation programs should be sized consistent with achieving restoration or rebuilding goals (including gene banking, reintroduction or other conservation goals). This may require deviation from the proportion guidelines mentioned above. Segregated harvest programs should be sized consistent with goals for potentially-affected stocks and habitat. This requires limiting negative genetic and ecological interactions with other stocks.

Incorporate Flexibility into Hatchery Design and Operation

Facilities should be designed and operated in such a way that they are able to respond relatively easily to changes in harvest and conservation goals and priorities, ocean carrying capacity, stock status, freshwater habitat conditions, and the myriad other factors that will alter current policies and programs. Programs must also be able to respond to uncertainty and risk. For example, an empty raceway today may be necessary to provide this type of flexibility in the future. The keys to flexibility are having sufficient supplies of land, water quality and quantity, and physical facilities; along with a planning mindset that takes the concepts of flexibility, managing change, and future needs into account.

Evaluate Hatchery Programs Regularly to Ensure Accountability for Success

Hatchery reform will require expanded monitoring and evaluation (M&E), with some level of commonality and standardization across Puget Sound and Coastal Washington. Each region of Puget Sound and the coast will need to develop its own M&E program consistent with the goals and programs of that region. Monitoring should include not only an expanded effort in tagging and marking subsets of all major hatchery production groups and recording of hatchery production parameters, but also determining the fate of migrants in fresh and saltwater environments following release. An integrated, region-wide hatchery M&E system needs to be developed that includes the

systematic and annual evaluation of the co-mingling of hatchery and natural fish. Furthermore, a modern, centralized M&E database that is evaluated annually for adherence to regional and area-wide goals needs to be institutionalized, in order to adaptively manage the system. Individual hatcheries need to be equipped with computers and Internet access that allow them to use and share data from a record collection system developed by the co-managers, such as the HatPro system. The Scientific Group applauds the progress tribal managers have made toward implementation in this area during the last year. The Scientific Group recommends that WDFW make implementation a high priority during the coming year.

Develop a System of Wild Steelhead Management Zones

The Scientific Group infers that the managers intend to operate segregated steelhead programs (as defined in the introduction of this report) throughout Puget Sound and the coast, to provide a steelhead harvest opportunity. In general, the Scientific Group has found that the ecological and genetic risks of this approach outweigh the benefits. The biggest concern is the genetic risk posed by the spawning overlap between the hatchery (Chambers Creek origin), early-timed winter run stock and the native, late-timed winter run stock.

The Scientific Group recommends an entirely new approach to managing steelhead. The managers should develop a system of "wild steelhead management zones" for each of the ten regions within Puget Sound and Coastal Washington, where streams are not planted with hatchery fish and are instead managed for native stocks. Harvest for steelhead within these zones may be compatible with this approach, but no hatchery-produced steelhead would be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. The streams selected should represent a balance of large and small streams, habitat types, stock status, etc. Hatchery production may need to be increased in streams selected for hatchery harvest.

The Scientific Group encourages actions to promote self-sustaining, segregated hatchery steelhead programs. Existing programs are based largely on steelhead of Chambers Creek origin winter and Skamania origin summer steelhead. When segregated hatchery steelhead programs are initiated, it will be necessary to import 100% of the eggs from other regions. However, the Scientific Group expects that, over time, returning adults will be used to obtain gametes. If necessary, harvest restrictions should be implemented to eventually achieve 100% locally-adapted Chambers or Skamania origin broodstock, and eliminate backfilling.

When implementing a segregated steelhead program, it is important to minimize interaction with naturally spawning steelhead, through such tools as differential timing and a decision on benefits versus risks on outplanting in freshwater habitat. In addition, adult collection procedures should be designed to capture as many adults from the returning segregated population as possible.

The Scientific Group also recognizes the role hatcheries can serve for conservation or supplementation, using native broodstocks with integrated stock management. It is important to recognize the differences between integrated stock management, incorporating native origin broodstock, and segregated stock management, using non-native origin broodstock.[9]

[9] *See HSRG Area-Wide Recommendation above on operating integrated and segregated hatchery programs.*

The managers should organize a workshop to develop this wild steelhead management zone concept. Monitoring and evaluation should be a basic component of the concept, for both wild steelhead management zones and hatchery harvest streams.

Use In-Basin Rearing and Locally-Adapted Broodstocks

Some hatchery programs, for lack of adequate facilities and/or proper escapement management, require the importation and movement of eggs and juveniles into and out of the region. In addition, non-locally adapted broodstocks are sometimes used. These practices result in a loss of local adaptability and lowered productivity of hatchery stocks and should be ended. The managers should use in-basin rearing and locally adapted broodstocks.

Take Eggs throughout the Natural Period of Adult Return

There is reason for concern over the loss of certain life history traits in hatchery stocks through the process of domestication. An example is the shift in spawn timing resulting from the failure to spread hatchery egg take over the natural period of adult return. Natural life history traits of the various hatchery stocks should be conserved or recovered to assure long-term sustainability. The managers should adopt and implement policies that effectuate this objective.

Develop Spawning Protocols to Maximize Effective Population Size

The mating of hatchery fish should strive to achieve two principal objectives: 1) maximize the genetic effective number of breeders; and 2) ensure that every selected adult has an equal opportunity to produce progeny. This is particularly critical in conservation programs, where populations are small or have experienced significant declines. To achieve this, male and female hatchery fish can be mated following pairwise (one male to one female), nested (e.g., one male to three females), or factorial (e.g., three-by-three spawning matrix) designs. One common hatchery practice, the pooling of sperm, can reduce effective population size, since equal contributions of individual males are not assured.

During its review of hatchery programs in the initial three regions, the Scientific Group saw a variety of spawning protocols, including modified factorial mating,[10] single family pairing, as well as protocols that pool gametes prior to fertilization. The approaches of single family mating and modified factorial mating have proven to be feasible and effective (up to 94% fertilization) even in some of the largest programs reviewed (up to five million eggs taken per year). Because these methods achieve the two principle objectives and can be implemented relatively easily, the Scientific Group recommends that all programs, up to the size noted, adopt one of these protocols.

Hatchery spawning protocols prescribed by the managers typically incorporate gametes from all age classes, including jacks (early returning males), to capture year-to-year genetic variation. A common approach by the co-managers is to use jacks for two percent of the adult male spawning population. This rate is probably lower than what occurs among natural spawning populations. The Scientific Group therefore recommends an initial rate of 10% jacks, with adjustment after investigations are made to determine jacking rates among natural spawning populations. The inclusion of jacks to maintain year-to-year genetic variation among coho is especially important, because they mostly mature at one age.[11]

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[10] *Currens, K.P., J.M. Bertolini, C.A. Busack, and J. Barr. 1998. An Easier Way to Meet Genetic Spawning Guidelines. Pages 41-44 in Proceedings of the 49th Pacific Northwest Fish Culture Conference, Boise, ID.*

[11] *Van Doornik, D.M., M.J. Ford, and D.J. Teel. 2002. Patterns of temporal genetic variation in coho salmon: estimates of the effective proportion of two year-olds in natural and hatchery populations. Transactions of the American Fisheries Society. 131: 1007-1019.*

Take Into Account Both Freshwater and Marine Carrying Capacity in Sizing Hatchery Programs

Stocks of coho and chinook have shown a decrease in survival over the past decade in certain regions of Puget Sound and the coast, such as southern Puget Sound. The decrease may be related to the general decline in productivity of marine waters. There has been a great deal of speculation as to additional cause(s) for the decline in these regions, (e.g., increased bird and marine mammal predation; a general lowering of water quality from urbanization in a body of water with low turnover; continuing loss of freshwater habitat, a shift in the forage base, etc). Whatever the cause, there seems to be reduced capacity to support hatchery and naturally spawning salmonids.

Lowered survival may be related to the biomass of salmonids presently being released from hatcheries, despite recent reductions in numbers of fish released. Because of scientific uncertainty associated with lowered hatchery productivity, production should not be increased until the managers have a better understanding of factors controlling survival. Closure of certain unproductive hatcheries and reduced production at other hatcheries may in fact benefit the quality and survival of both naturally spawning and hatchery fish. The Scientific Group is preparing a white paper addressing this issue.[12]

Reduce Risks Associated with Outplanting and Net Pen Releases

Releasing smolts in streams geographically removed from a hatchery or adult collection facility is commonly called outplanting. Steelhead programs in Puget Sound and Coastal Washington have often used outplanting to support sport fisheries in a large number of small streams. Similarly, saltwater net pens are used to acclimate and release salmon smolts in marine areas where a targeted marine fishery on returning adults is desired.

A common feature of these programs is that they release fish where no facilities exist to trap returning adults that escape target fisheries. This may pose significant genetic risks by promoting stray rates, often exceeding natural levels, to freshwater areas where interbreeding with naturally spawning populations is undesirable. Outplanting and net-pen releases from segregated hatchery programs[13] are especially problematic, because of the potentially high level of genetic divergence between the hatchery stock and natural populations where straying and natural spawning may occur.

The simplest way to reduce risks associated with outplanting and net-pen releases is reduce the number and/or size of existing programs. Risks can also be reduced by: 1) intense, selective harvest and/or the use of adult traps; 2) implementing the HSRG's Area-Wide Recommendations for steelhead, to substantially reduce the geographic range of outplanting; 3) restricting release to areas where adult collection facilities are available or can be easily developed; 4) using locally-adapted and integrated stocks[14] in net pens, so that strays have less of a deleterious effect on natural populations; 5) marking all net pen released fish each year, and coded wire tagging a significant proportion, to assess the direct contribution to targeted fisheries, stray rates, and biological risks to natural populations; 6) evaluating the benefits and risks of each program every two or three years, and reducing or terminating programs that impose significant risks relative to benefits; 7) monitoring and evaluating high risk programs to ensure that adverse effects to wild populations are minimal, that straying risks are appropriately managed, and that off-station releases are appropriately located; and

[12] *See HSRG Scientific Framework and Hatchery Review Program, Emerging Issues chapter, section on marine carrying capacity.*

[13] *See HSRG Area-Wide Recommendation above on operating integrated and segregated hatchery programs.*

[14] *Ibid.*

8) developing area-wide, risk management guidelines and protocols for outplanting and net-pen programs.[15]

Have Clear Goals for Educational Programs

The Scientific Group applauds and strongly supports the many educational programs conducted at, or supported by, hatchery facilities across Puget Sound and Coastal Washington. These programs are valuable for educating the public on the biology of salmon, the importance of maintaining healthy salmon habitat, and sustainable fisheries. A clear understanding of the program's specific educational goals needs to be included, along with methods for determining if those goals are being met and for reporting educational benefits. It is incumbent upon the fisheries managers, as the professional partners of these often volunteer-driven programs, to ensure that such goal statements are developed for these programs and understood by participants. It is also essential that these programs are operated consistent with conservation principles.

[15] *See HSRG Scientific Framework and Hatchery Review Program, Emerging Issues chapter, section on out-planting and net pens.*

❖Skagit River Basin

Overview

This region includes the watersheds contained by the Skagit River Basin. For the purposes of this review, the Scientific Group reviewed the hatchery programs involving each identified regional salmonid stock (for example, Skagit spring chinook). The review included a consideration of the program's effects on all other hatchery and naturally spawning regional salmonid stocks (see table below under Stock Status). This chapter provides an overview of the Skagit region, followed by reviews and recommendations for each salmonid stock that has an associated hatchery program.

FISHERIES[16]

Chinook, pink, coho and chum salmon harvest management in the Skagit region is directed primarily towards the needs of natural production. Hatchery releases are primarily intended for indicator stock research and escapement estimation, but coho fisheries targeting hatchery returns have been conducted in Swinomish Channel, Oak Harbor, and the Cascade River, and the co-managers are considering isolated harvest fisheries for chinook that could be conducted in future years on returns to such potential sites as Similk Bay, Swinomish Channel, the Baker River, and the Cascade River. Sockeye salmon harvest management in the region is directed primarily towards filling the Baker Lake artificial spawning beaches. Spawners in excess of spawning beach needs are used for harvest, tribal ceremonial and subsistence purposes, and to test the natural production capabilities of the Baker system.

Winter steelhead harvest management in the region is directed primarily towards harvesting surplus hatchery and wild production during the early part of the run, then reducing harvest intensity when the wild run predominates, in order to achieve wild escapement objectives. Summer steelhead recreational harvest management in the region is directed primarily towards harvesting hatchery steelhead and avoiding retention of wild steelhead. There are no tribal fisheries that target summer steelhead, and there are no escapement goals for summer steelhead in this region.

Pre-terminal harvests of hatchery and natural-origin fish occur primarily in Canada, the Washington ocean fisheries, north and central Puget Sound, and in the Strait of Juan de Fuca. Terminal harvests on hatchery and natural-origin coho, chum, pink, sockeye and steelhead occur primarily in the Skagit River and Skagit Bay. Where possible, harvests are scheduled and located to target harvestable wild and hatchery-origin fish and minimize the harvest of listed chinook and other depressed stocks. There is no targeted terminal harvest on natural-origin even-year pink salmon. Sea-run cutthroat and bull trout/Dolly Varden management is based entirely on natural production.

In the Skagit terminal area, the biggest fisheries (in terms of numbers) are those directed at pinks and chums. Coho harvests have become more substantial during the last ten years, and chinook harvests, which were once the primary income-producer, have declined sharply. Baker sockeye catches have been low, but it is possible that they have the potential for significant increases. For tribal ceremonial and subsistence purposes, the primary sources are Baker sockeye and test fishery catches of hatchery and wild spring chinook, summer chinook, coho, and chum.

[16] *Darrell Mills, Washington State Department of Fish and Wildlife and Bob Hayman, Skagit System Cooperative, November 2002.*

CONSERVATION[17]

All Puget Sound chinook are currently managed under the *Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component*, March 23, 2001. The intent of this plan is to maintain exploitation rates on natural chinook populations at or below levels that will allow them to rebuild as habitat conditions improve to allow greater production. All spring, summer and fall chinook hatchery enhancement efforts within the Skagit Basin are aimed at conserving the native stocks and providing Pacific Salmon Treaty (PST) index stocks and wild stock indicators. The summer and fall programs may also be used to supplement natural production. The spring program was originally intended to be used for supplementation, but would now be used for that purpose only if Suiattle chinook failed to respond to current rebuilding efforts.

Puget Sound coho are currently managed under preliminary exploitation rate guidelines and escapement breakpoints from the co-managers' *Comprehensive Coho Management Plan*. Natural origin chum have been managed for fixed escapement goals, with different goals set for odd-year and even-year returns. Sockeye conservation efforts are focused primarily in the Baker River system. Escapement levels to the Baker system are aimed at achieving spawning beach capacities that were established by mitigation agreements with Puget Sound Energy, and at determining the natural production potential in the Baker System. Odd-year pinks are managed so that the expected natural spawning escapement exceeds the goals for the Skagit River. Even-year pinks have occurred in significant numbers only during the last two cycles. No management objectives have been established for even-year pinks.

The goal of regional winter steelhead management is to harvest surplus hatchery steelhead while restricting the harvest rate on wild steelhead to a low enough level to test the capacity of the Skagit system for producing wild steelhead. Under the management strategy for sea-run cutthroat, minimum size limits were set so that the majority of females are allowed to spawn at least once. Harvest under this scenario is allowed only where stocks are thought to be healthy and such harvest is consistent with management objectives.

HABITAT

Skagit River[18]

The Skagit River basin drains approximately 8,030 km^2 (3,190 mi^2) of the North Cascade Mountains of Washington state and British Columbia. Major tributaries include the Sauk, Suiattle, White Chuck, Baker and Cascade rivers. Elevations in the basin range from sea level to about 3,275 m (10,775 ft) on Mount Baker. Numerous peaks in the basin exceed 2,500 m in elevation. Average annual rainfall ranges from about 90 cm (35 in) at Mount Vernon on the lower flood plain, to over 460 cm (180 in) at higher elevations in the vicinity of Glacier Peak. Several vegetation zones occur in the area. Most of the lower elevations are in the western hemlock zone and the Puget Sound area. These forest zones typically include western hemlock, Douglas fir, western red cedar, and Sitka spruce. Deciduous species in this area include red alder, black cottonwood, and big leaf maple. Middle elevations are in the Pacific silver fir zone, and higher elevations are in the alpine fir zone.

[17] *Ibid.*

[18] *Brett Barkdull, Washington State Department of Fish and Wildlife, March 2002.*

About 1590 km^2 (615 mi^2, 19%) of the basin are in private and State of Washington ownerships. Land uses are dominantly agricultural and urban in the lower flood plain and delta areas. Upland areas are generally commercial forests. About 3680 km^2 (1420 mi^2, 44%) of the basin lies within the federally-owned North Cascades National Park, Mount Baker and Ross Lake National Recreation Areas, and Glacier Peak Wilderness Area. The US Forest Service controls an additional 1960 km^2 (755 mi^2, 24%) of the basin in the Mount Baker-Snoqualmie National Forest. Approximately 1040 km^2 (400 mi^2, 13%) of the basin is in the Province of British Columbia.

Access to anadromous fish is generally confined to streams at elevations below 700 m (2300 ft). Unrestricted access to the Baker River system has been eliminated by the installation of two hydroelectric dams, but anadromous fish production—primarily coho and sockeye salmon—is maintained through trapping and hauling operations, in addition to the maintenance of sockeye spawning beaches and smolt bypass trapping. Three hydroelectric dams regulate flows in the upper Skagit River, the first near the town of Newhalem. No anadromous stocks were known to utilize the Skagit River above the current location of the Gorge Power plant. Salmonid stocks present in the basin include chinook salmon, coho salmon, sockeye salmon, chum salmon, pink salmon, steelhead trout, cutthroat trout and Dolly Varden/bull char.

Baker River[19]

The Baker River project has two dams. One creates Baker Lake and the other creates Lake Shannon. Mount Baker is the defining feature of the region. Mountains border most of the upper Baker River region.

The Baker River enters the Skagit River at river mile 56.5, at the town of Concrete. The Baker River is about 32 miles long, with about 114 tributaries that add up to 314 miles. Only 14 of the 32 miles of the Baker River have flowing water. The river has two large hydropower dams and one fish barrier dam. The fish barrier dam is located 0.25 miles from the mouth of the Baker River. Adjacent to the fish barrier dam is a fish trap for moving adult fish upstream. The Lower Baker Powerhouse is located at river mile 0.9. Lower Baker Dam is at river mile 1.1. Lake Shannon is the reservoir behind Lower Baker Dam. It extends 8.1 miles up to Upper Baker Dam at river mile 9.1. Baker Lake is the 10.1 mile reservoir behind Upper Baker Dam. When Baker Lake is full, it extends to just beyond river mile 19. Prior to construction of Upper Baker Dam there was a natural lake between river mile 16 and 18. This was the historic Baker Lake. There are 20 tributaries to Lake Shannon, with 96.35 miles. Baker Lake has 17 tributaries, with 129.5 miles. There are 13 miles of the Baker River above Baker Lake, with 25 tributaries and 88 miles.

The Baker River Basin has a drainage area of 297 square miles, including snowfields on Mount Baker and Mount Shuksan. The Baker River originates in the North Cascades National Park. The river passes into the Mount Baker National Forest at about river mile 22, three miles above Baker Lake. The river then enters the upper reservoir (Baker Lake) and has Shannon, Swift, Boulder, Noisy, Park, and Sandy creeks as major tributaries. Baker Lake is bordered on the north and east by North Cascades National Park and the south and west by Mount Baker National Forest service land and Puget Sound Energy land, with some private ownership. Lake Shannon starts at the tailrace of the Baker dam and has Rocky, Diversion, and Bear creeks as major tributaries. Land surrounding Lake Shannon is likely owned by a combination of the following groups: the US Forest Service, Lone Star, Trillium Corporation, Puget Sound Energy, and private ownership.

[19] *Puget Sound Energy and Gary Sprague, Washington State Department of Fish and Wildlife, March 2002.*

Habitat Condition[20]

In general, the headwater areas of the Skagit River and its major tributaries originate from the North Cascades National Park, National Recreation Area, or one of several designated wilderness areas, and are in near-pristine condition. As you move downstream of these protected areas, down the watershed toward first rural and then urban areas including Mount Vernon and Burlington, the human impacts to the watershed both accumulate and increase in frequency, and the cumulative impacts to the associated streams and their habitats multiply. The most degraded habitats occur in the lower mainstem and estuary, where cumulative impacts are greatest and major hydro-modifications have occurred to prevent flooding, allow farming and settlement. Much of the rearing capacity for all species has been lost in the lower river below Sedro-Woolley and it has been estimated that 70% of the original Skagit estuary has been lost. Within these affected areas are mosaics of habitat qualities. Some streams and reaches are lower in quality, due to point disturbances. Specific habitat comments pertaining to individual reaches are as follows:

Skagit River Newhalem to Marblemount: Three dams regulate the flows in this reach, the first just above the town of Newhalem. The dams affect this reach by obstructing sediment movement and intercepting woody debris recruitment that has led to down cutting of the streambed, isolation of off-channel habitat, and a loss of spawning gravels. In spite of this, a large percentage of the spawning population for chinook, chum and pink salmon occur in this reach, due to the stability. Some impacts have occurred due to hydro-modification. Tributaries are generally in excellent condition and productive.

Skagit River Marblemount to mouth of Sauk River: This is a highly productive reach for all species, in spite of the many impacts due to hydro-modification, forest practices and suburbanization. Tributaries are generally in poor shape, except for Illabot Creek, which originates in the Glacier Peak Wilderness.

Skagit River, Sauk River to Alder Creek: This confined reach, which was once only modestly productive, is generally in poor condition due to cumulative impacts. Tributaries are in poor shape due to forest practices

Skagit River below Alder Creek: This was once a highly productive reach for all species, but is no longer. Extensive hydro-modification has occurred throughout this reach. The Ross Island/Day Creek Slough area is still mostly intact and extremely productive. The tributaries have all been heavily affected by forest practices. Farming and suburbanization have further degraded the Nookachamps system.

Skagit River Estuary: Approximately 70% of the original estuary area has been lost due to diking. Much of the rest is degraded. The area bracketed by Tom Moore and Freshwater sloughs on the South Fork Skagit is the only marginally functional area.

Cascade River: The upper Cascade River is in excellent condition, with only isolated impacts, mostly due to roads. Some forestry-related activity has occurred, but those areas are currently in recovery. The lower Cascade is more heavily affected by forest practices and by hydro-modification, on the left bank by private landowners and by the WDFW Cascade River hatchery near the mouth. This is a productive tributary for most species.

[20] *Brett Barkdull, Washington State Department of Fish and Wildlife, March 2002.*

Sauk River above Darrington: The upper Sauk is generally in excellent condition, but has had impacts from roads and forestry, and from hydro-modification at two small communities—Bedal and Forgotten Mountain. Forestry activities continue. Spawning and rearing habitat quality is high, but decreases downstream of the White Chuck River, due to gradient. This is a productive tributary for most species.

Sauk River below Darrington to the mouth of the Suiattle River (Sauk Prairie). This is a highly productive reach for all species, due to the extensive floodplain in the unconfined reach above the mouth of the Suiattle River. There have been moderate to high impacts to the tributaries from forestry, farming and private residences.

Sauk River, Suiattle to mouth: Habitat quality is much lower in the confined reach below the Suiattle River, due to forestry practices, increasing human impacts, hydro-modification and glacial flour from the Suiattle River. Tributaries are generally in moderate to poor shape. This is not nearly as productive a reach as Sauk Prairie.

White Chuck River: The White Chuck River is glacial in nature and high in gradient, with moderate turbidity due to glacial flour during summer. Habitat is nearly pristine, but low in productivity for most species except char.

Suiattle River: The Suiattle is a glacial river, with extremely high turbidity during summer. The glacial flour has a natural impact on habitat quality in the Suiattle River, the Sauk River below its confluence, and the Skagit River below the confluence of the Sauk River. The impact seems to be increasing recently as glaciers recede on Glacier Peak. Spawning occurs in the clear water tributaries of this drainage and the spawning habitat is mostly pristine. Big, Tenas, Straight, Circle, and Lime creeks—important spawning tributaries—have all been affected to varying degrees by forestry-related activities; all are currently in recovery. Forestry impacts increase in the lower river, where most land is privately owned. This is a moderately productive tributary.

Baker River: The Baker River originates from the North Cascades National Park and then flows into two reservoirs—first Baker Lake and then Lake Shannon. The river above Baker Lake is in near pristine condition and very productive for coho and char. Baker Lake is very productive for sockeye, but is somewhat impacted by heavy recreational use. Fish can only get into Lake Shannon if spilled at upper Baker Dam. Fish production is limited in this system by the inefficient juvenile collection facilities at the two dams.

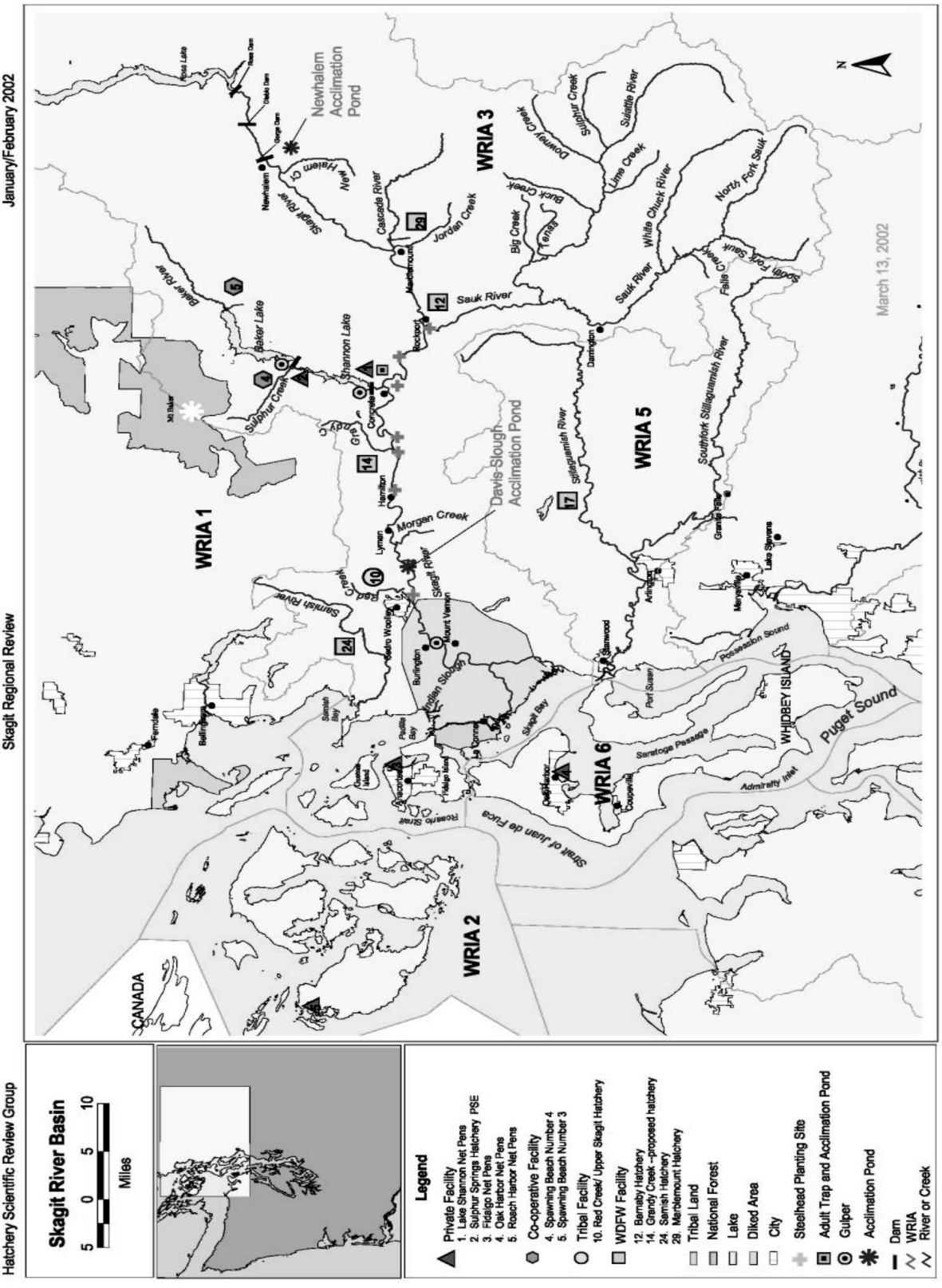
Habitat Improvement[21]

The following habitat improvement projects are in process for this region: 1) a complete fish passage inventory of man-made structures in the Skagit Basin has been completed and efforts are underway to repair fish passage barriers; 2) restoration planning and implementation is underway in the hydro-modified reaches of the Skagit Basin by removing rip-rap and diking, and allowing natural channel forming process to occur; 3) estuary restoration is in the planning stage; 4) minimum riparian buffers on all fish bearing streams are in the planning stage.

The quality of habitat in this region will probably stay about the same in the next ten to twelve years, even though major restoration efforts are currently underway. These efforts will likely be offset by habitat losses due to population growth. The long term may well be a "mixed bag." As growth

[21] *Provided by Brett Barkdull, WDFW*

continues into rural areas, many habitats will continue to be degraded. But there has been recognition of the importance of the floodplain and estuary habitats, and major efforts are being discussed in the estuary and the floodplain to purchase and restore these areas. The long-term WDFW goal is no net loss of habitat.


Hatchery Scientific Review Group
Skagit Regional Review
January/February 2002
Skagit River Basin
5 0 5 10
Miles
Legend
Private Facility
1. Lake Shannon Net Pens
2. Sulphur Springs Hatchery PSE
3. Fidalgo Net Pens
4. Oak Harbor Net Pens
5. Roach Harbor Net Pens
Co-operative Facility
4. Spawning Beach Number 4
5. Spawning Beach Number 3
Tribal Facility
10. Red Creek/ Upper Skagit Hatchery
WDFW Facility
12. Barnaby Hatchery
14. Grandy Creek –proposed hatchery
24. Samish Hatchery
29. Marblemount Hatchery
Tribal Land
National Forest
Lake
Diked Area
City
Steelhead Planting Site
Adult Trap and Acclimation Pond
Gulper
Acclimation Pond
Dam
WRIA
River or Creek
CANADA
WRIA 1
WRIA 2
WRIA 3
WRIA 5
WRIA 6
Newhalem Acclimation Pond
Davis Slough Acclimation Pond
Skagit River
Sauk River
Baker Lake
Shannon Lake
Ross Lake
Diablo Dam
Gorge Dam
Newhalem
Marblemount
Rockport
Concrete
Hamilton
Lyman
Morgan Creek
Red Creek
Mount Vernon
Burlington
Bellingham
Ferndale
Samish Bay
Padilla Bay
Fidalgo Island
Anacortes
La Conner
Skagit Bay
Oak Harbor
Coupeville
Whidbey Island
Saratoga Passage
Admiralty Inlet
Port Susan
Stanwood
Arlington
Marysville
Lake Stevens
Possession Sound
Puget Sound
Strait of Juan de Fuca
Roseario Strait
Cascade River
Jordan Creek
Sulphur Creek
New Halem Cr
Baker River
Mt Baker
Grandy Cr
Big Creek
Texas Creek
Buck Creek
Downey Creek
Sulphur Creek
Lime Creek
Suiattle River
White Chuck River
North Fork Sauk
South Fork Sauk
Falls Creek
Sauk River
Stillaguamish River
Southfork Stillaguamish River
Granite Falls
Darrington
March 13, 2002
N

STOCK STATUS[22]

Stocks	Hatchery Program?	Biological Significance (L=Low, M =Intermediate, H =High)			Population Viability (L=Critical, M = At Risk, H = Healthy)			Habitat (L = Inadequate, M = Limiting, H = Healthy)			Harvest Opportunity (0 = None, L = Occasional, M = Most years, H = Each year)		
		Now	Goals		Now	Goals		Now	Goals		Now	Goals	
			Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term
Skagit/Cascade Spring Chinook	N	H	H	H	M	M	H	M	M	H	L	M	H
Skagit/Sauk Spring Chinook	N	H	H	H	M	M	H	M	M	H	L	M	H
Skagit/Suiattle Spring Chinook	N	H	H	H	M	M	H	M	M	H	M	M	H
Skagit/Sauk Summer Chinook	N	H	H	H	M	M	H	M	M	H	L	M	H
Skagit River Summer Chinook	Y	H	H	H	H	H	H	M	M	H	L	M	H
Skagit River Fall Chinook	Y	M	M	M	M	M	H	M	M	H	L	M	H
Skagit Hatchery Spring Chinook	Y	M	M	M	M	H	H	M	M	M	M	M	M
Spring Chinook in Baker	Y	L	L	M	L	M	H	L	L	M	0	L	M
Skagit River Coho	N	M	M	M	H	H	H	M	M	H	M	H	H
Skagit River Hatchery Coho	Y	M	M	M	H	H	H	M	M	H	M	M	H
Baker/Skagit Coho	Y	L	L	M	L	L	M	L	L	M	M	M	H
Other Hatchery Coho	Y	L	L	L	H	H	H	L	L	L	H	H	H
Skagit River Odd-Year Pink	N	M	M	M	H	H	H	H	H	H	H	H	H
Skagit River Even-Year Pink	N	H	H?	H?	M	M?	M?	M	M	M	0	0	0
Skagit/Baker River Sockeye	Y	H	H	H	M	M	M	L	M	M	M	H	H
Skagit Riverine-type Sockeye	N	H	H	H	M	M	H	M	M	H	L	L	L
Skagit River Chum	Y	M	M	M	H	H	H	M	M	H	H	H	H
Skagit River Natural Winter Steelhead	N	H	H	H	M	M	H	M	M	H	M	M	H
Skagit River Hatchery Winter Steelhead	Y	L	L	L	M	M	H	M	M	H	H	H	H
Skagit River Natural Summer Steelhead	N	M	M	M	M	M	H	M	M	H	M	M	H
Skagit River Sea-run Cutthroat	N	M	M	M	M	M	H	M	M	H	M	H	H
Upper Skagit Basin DV/Bull Trout	N	M?	M?	M?	M?	M?	H?	M	M	H	H	H	H
Lower Skagit Basin DV/Bull Trout	N	M?	M?	M?	M?	M?	H?	M	M	H	H	H	H

Biological significance *is determined by considering a number of specific factors relating to stock origin, biological attributes and population subdivisions, with the stock defined as being of either* low, intermediate *or* high *significance.*

Population viability *is determined by considering a number of specific factors such as age class structure, spawner escapement and proportion of hatchery-origin fish in natural spawning, with the stock's viability defined as being either* critical, at risk *or* healthy. *This rating refers to the stock's ability to sustain itself in the natural environment (except in the case of a segregated harvest program, in which case the ratings are* low, medium *and* high *and refer to the stock's ability to sustain itself in the culture environment).*

The stock's spawning, freshwater, migration and estuarine ***habitat*** *is rated as either* inadequate *(target stock is unproductive and the population will go extinct, even without terminal harvest),* limiting *(target stock is productive enough for the population to sustain itself at a low level terminal harvest) or* healthy *(productivity of the stock is high and the population is capable of growth and supporting significant terminal harvest).*

Harvest opportunity *is rated according to whether the goal is to provide* no *directed harvest opportunity,* occasional *opportunity, opportunity* most years, *or opportunity* each year.

[22] *This table contains ratings for all the salmonid stocks in the region, as provided by the managers. For a more detailed definition of these ratings, see HSRG Scientific Framework and Hatchery Review Program, Benefit/Risk Tool chapter.*

HATCHERIES[23]

Marblemount Hatchery

Marblemount Hatchery is located one mile east of Highway 20 and the town of Marblemount on Fish Hatchery Road. It is on the Cascade River, about one mile upstream from the confluence of the Cascade and Skagit rivers. Clark Creek passes through, and the Jordan River skirts, this site. The land is owned by WDFW. There are three residences, one hatchery building and an old storage building. There are two pump intakes, one gravity intake and five wells (of which four work). The State General Fund supports this facility. Currently, the incubation room has 66 new vertical incubators and 16 new indoor starter tanks. There are 21 10' X 100' X 3' raceways, four large asphalt rearing ponds, one large earthen rearing pond, and one large asphalt adult trapping and holding pond. The hatchery rears spring, summer and fall chinook (all Skagit River origin), coho (Skagit, Minter, and Wallace river origin), and winter-run steelhead (Chambers Creek origin). Skagit River wild rainbow were reared once at this facility.

Barnaby Slough

Barnaby Slough rearing pond is located on Martin Ranch road about three miles from the town of Rockport. The land is owned by Seattle City Light and leased to WDFW. The outflow from the ponds enters the Skagit River about one mile above the bridge at Rockport. Barnaby has one large rearing pond with a gravity water supply, two adult traps, two small raceways used for steelhead production, and five wells (of which three work). There is also a small egg incubation building not currently being used. There is one residence on site. The State Wildlife Fund supports this facility. Barnaby Slough rears Chambers stock, hatchery origin winter steelhead. These fish support an intensive recreational fishery along the entire length of the Skagit River, below the dams and a tribal net fishery in the lower river.

Baker Spawning Beaches/Sulphur Creek Hatchery

The Baker Spawning Beaches are located on the Baker River and owned by Puget Sound Energy (PSE), as mitigation for two dams on the Baker River. The facility consists of an adult trap on the lower Baker River and four artificial spawning beaches along Baker and Shannon lakes. Beaches number one, two and three are on Channel Creek, a spring fed water supply at the upper end of Baker Lake. Only beach three is operational. The site is on about ten acres of US Forest Service (USFS) property leased to PSE. There are three buildings: an A-frame that used to be a residence, a large galvanized storage building with a cement slab, and a small, galvanized building over the screens at the intake. PSE owns all buildings and equipment. Beach four was built at the mouth of Sulfur Creek, just below the Baker Dam, because of the risk to beaches one through three from the instability of the Baker River, as far as its course near the delta. The intake is on USFS property and is a spring source that feeds by gravity to a "denitro" tower, then on to beach four. Effluent water drains into Sulfur Creek. Beach four is divided into four sections, using hypolon curtains, for improved disease control. There is a 20 X 20 chemical storage building and an office/storage building at this site, both owned by PSE. WDFW, with PSE, will build an additional incubation facility (vertical incubators) at this site in 2002. This site is less than ten acres and shares water with PSE's fish culture facility, just adjacent, where there are five circulars, four small raceways, two starter troughs, and an asphalt pond. There are five small buildings for office and storage space. PSE operates several small rearing ponds to rear coho (for dam gulper testing) and rainbow trout (for recreational enhancement in the lakes).

[23] *Darrell Mills, Steve Stout and Kevin Kurras, Washington State Department of Fish and Wildlife, March 2002.*

Upper Skagit/Red Creek Hatchery

The Upper Skagit Hatchery is on the Upper Skagit Reservation and draws water from Red Creek # 268, which is on Skagit River kilometer 36.62. This program is tribally owned and operated by the Skagit System Cooperative, the fisheries consortium of the Upper Skagit, Swinomish and Sauk-Suiattle tribes. The Bureau of Indian Affairs is the current funding source for the hatchery and raceways. This facility is operated with one full-time and one part-time position. The goal of this facility is to increase the harvestable numbers of chum salmon returning to the Skagit River for a tribal chum fishery. This program provides additional surplus chum salmon for treaty net fisheries in WDFW Areas 8 and 78-D, Skagit Bay and Skagit River. The program also benefits the non-treaty net and sport fisheries in the same areas.

Skagit River Summer Chinook

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	High	High	High
Population Viability	Healthy	Healthy	Healthy
Habitat	Limiting	Limiting	Healthy
Harvest Opportunity	Occasional	Most Years	Each Year
Hatchery Program:			
Purpose	Indicator, with Secondary Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

The Skagit summer chinook program began in 1995. The primary purpose of this program is to establish an exploitation rate indicator stock to represent the Skagit River natural summer chinook stock. Secondary purposes include contributing to harvest, plus serving as a gene bank in case of catastrophic stock crash. Skagit summer chinook derive from, and are maintained by, adults collected in the upper Skagit River (between river mile 80 and 84). These chinook are in the Stillaguamish and Skagit GDU. 200,000 fingerlings are released from County Line Pond (river mile 91) into the Skagit River. Approximately 90 adults (40 females) are collected by gillnet from Skagit River spawning grounds (river miles 80–84). Spawning, incubation and early rearing take place at Marblemount Hatchery.

OPERATIONAL CONSIDERATIONS

- Adults are collected from natural stock (although some hatchery returns may be used in the program) at random, over the length of the spawning season.
- Adults are selected randomly for spawning and mated with single family pairing using a primary and back-up male.
- Incubation and rearing take place on well water that does not reflect the water temperature regime of the natural environment, but is used to reduce homing to the hatchery upon return as adults.
- Fish are released at a time and size (75 fish per pound in June) similar to their wild counterparts.
- Releases are 100% adipose fin clipped and coded wire tagged.
- Adult sampling and recovery on the spawning grounds does not meet performance standard cited in the US/Canada Type I Indicator Stock proposal.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
Understanding the exploitation rates of intercepting fisheries, the program is consistent with the indicator stock goals established for this stock.

B. Likelihood of attaining goals?
This program is likely to provide information on the catch distribution of Skagit River summer chinook, but accurate estimation of exploitation rates also requires adequate recovery of tagged fish in the natural escapement. Since tag recoveries rates from spawning ground surveys are generally lower than recoveries from trapping facilities, there is likely to be a wide variance in escapement and exploitation rate estimation. There appear to be no significant risks to the target population because of the relatively small size of the hatchery program, the broodstock source and operational guidelines. However, during years of low adult returns, there is a risk to the natural population from "broodstock mining," if the return rates and subsequent production from natural spawning of the program fish are significantly lower than the natural population as a whole.

A program of this size is unlikely to achieve a harvest benefit offsetting the reduction in natural spawning resulting from adults removed for the program. No gene bank conservation program is necessary for a stock whose population viability is rated as healthy.

C. Consistent with goals for other stocks?
The program poses no significant risk to other stocks and is consistent with the goals for those stocks.

RECOMMENDATIONS

- Evaluate whether or not there are other stocks that could be used as an indicator for this stock and would provide a more precise estimate of exploitation and rebuilding rates, without the added cost of maintaining this program
- Discontinue the program if these conditions can be met and/or if the adult sampling effort on the spawning grounds cannot be improved sufficiently to reduce variance and meet US/Canada standards.

COMMENTS

- The HSRG recognizes that a number of ongoing processes expect to benefit from this indicator program and that a thoughtful transition would be required to move to another stock.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Skagit River Fall Chinook

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Intermediate	Intermediate	Intermediate
Population Viability	At Risk	At Risk	Healthy
Habitat	Limiting	Limiting	Healthy
Harvest Opportunity	Occasional	Most Years	Each Year
Hatchery Program:			
Purpose	Indicator, with Secondary Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

The Skagit fall chinook program began in 1998. Skagit fall chinook derive from, and are maintained by, adults collected in the lower Skagit River (river mile 32–42) from September 20 through November 7. These chinook are in the Stillaguamish and Skagit GDU. 222,000 fingerlings are released into the Baker River from the Baker Trap acclimation ponds. Adults (40 pairs) are collected by gillnet from lower Skagit River spawning grounds (river miles 32-40). Spawning, incubation and rearing take place at Marblemount Hatchery.

OPERATIONAL CONSIDERATIONS

- Eggs and resulting hatch are reared in well water at Marblemount Hatchery, to minimize the risk that adults will return to the hatchery.
- Fish are released as fingerlings (sub-yearlings) at a time and size that mimics that of their wild counterparts (no yearlings are reared for release, although yearlings are a component of the wild fall chinook population).
- All releases are adipose fin clipped and coded-wire tagged.
- For release, fish are trucked to the Baker Trap, where they are held (acclimated?) for three days and then released (release site is in the natural spawning zone of the stock).
- Duration of the program is described as “on-going.”
- Adult sampling and recovery on the spawning grounds does not meet performance standard cited in the US/Canada Type I Indicator Stock proposal.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

This indicator program would provide a benefit if it can indeed serve as a valid indicator stock and if fisheries management is altered as a result. However, it is potentially in conflict with conservation goals for this at-risk stock. The potential risk is that adults resulting from the releases will return to Baker Trap, rather than to their natural spawning grounds. Were this to occur, it could have a deleterious (“broodstock mining”) effect on the stock.

B. Likelihood of attaining goals?
It seems likely that the program will yield data on catch distribution, but its value as an indicator stock is questionable, because of the difficulty foreseen in collecting adequate numbers of adult samples on the spawning grounds in the large, fast-flowing, turbid Skagit River. In view of the small size of the program, no significant conservation or harvest benefits are likely to result. In order for this program to be successful, a large number of adults need to return to the Baker Trap, where they will be sacrificed for coded-wire tags.

C. Consistent with goals for other stocks?
Considering the life stage released and the relatively small size of the program, the program is not likely to pose any significant risks to other stocks in the drainage.

RECOMMENDATIONS

- Continue this program only for a period sufficient to determine how well its harvest contribution pattern correlates with the summer chinook stock.
- Consider, at the same time, whether there is another stock more suitable for the indicator stock purpose. If so, use that stock in place of the Skagit fall chinook. The selected indicator stock should not only be representative of Puget Sound fall chinook, but should occur in a river that is amenable to adequate adult carcass sampling.
- Increase the acclimation period to a minimum of 30 days (the longer the better), at a suitable location on the lower river, to increase juvenile imprinting to the return site.
- If there is no other more suitable indicator stock and the program continues, develop an integrated program for the long term, using returns from this program and incorporating 10–20% naturally-spawning fish for broodstock each year.[24]

COMMENTS

- The principal value of this program is in determining how well its harvest contribution pattern correlates with the summer chinook stock. There is a significant conservation tradeoff for fall chinook in pursuing this experimental indicator stock program.
- The co-managers, in a verbal communication, have indicated that they are hoping sampling of the program's returning fall chinook adults will be facilitated by collecting those returning to the release site (Baker Trap). However, it is not at all certain that a three-day acclimation period at Baker Trap would ensure significant returns to the trap. In addition, should returns occur at the trap, identifying their source would require slaughter. This would result in loss of contribution to the "at-risk" population, unless the hatchery program is modified to include the rearing and release of progeny from adults collected at Baker Trap.

MANAGERS RESPONSE

WDFW generally supports the recommendations of the HSRG. However, if the program continues, WDFW notes that identification of the source and number of broodstock is a complex topic that will require discussion with the affected tribes.

[24] *See HSRG Area-Wide Recommendation on operating integrated and segregated hatchery programs.*

Skagit Hatchery Spring Chinook

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Intermediate	Intermediate	Intermediate
Population Viability[25]	Medium	High	High
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Most Years	Most Years	Most Years
Hatchery Program:			
Purpose	Indicator and Cultural, with Secondary Conservation		
Type	Segregated		

PROGRAM DESCRIPTION

Fish for this program were derived from wild fish collected from six Suiattle River tributaries and from Marblemount Hatchery adult returns and unmarked volunteers from 1974–88. This stock has been maintained exclusively with marked adults (approximately 100 pairs) returning to the Marblemount Hatchery since 1989. Skagit hatchery spring chinook are in the Stillaguamish and Skagit GDU. The principal goal of this program is to serve as an index stock for spring chinook in the Skagit River.

OPERATIONAL CONSIDERATIONS

- A secondary goal of this program is to provide a conservation "back-up" for natural spring chinook in the Suiattle River (although WDFW may be abandoning this goal). This stock also makes an important contribution to tribal ceremonial and subsistence fisheries.
- A total of 486 wild fish (277 females, 209 males) were collected from the Suiattle River tributaries during the establishment of the program, although a major fish loss in 1981 due to water failure reduced those numbers to 254 females and 171 males, or an average of only 17 females and 11 males per year during the period 1974–88. In addition, a total of 26 unmarked males and 35 unmarked females, presumably representing wild fish volunteers from the Cascade River population, were included in the broodstock 1981–84. Approximately 12% of the hatchery population may have thus been derived genetically from Cascade River strays.
- Genetic (allozyme frequency) comparisons among Suiattle spring chinook, Upper Sauk spring chinook, Upper Skagit summer chinook, lower Skagit fall chinook, lower Sauk summer chinook , and Skagit Hatchery spring chinook showed that the Skagit Hatchery spring chinook stock had the largest, average genetic distance to the other stocks than those other stock had among themselves (*WDFW unpublished data*). These results are consistent with the hypothesis that the Skagit Hatchery spring chinook stock has experienced significant genetic change from the

[25] *In the case of a segregated program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

Suiattle River population due to founder effects, genetic drift, and/or other genetic factors associated with artificial propagation.

- 250,000 sub-yearlings are released in June at 70 to the pound. All are adipose fin-clipped and coded-wire tagged.
- 150,000 yearlings are released the following April at ten to the pound. 75,000 are adipose fin-clipped and coded-wire tagged; 75,000 are coded-wire tagged only.
- Sub-yearlings are allowed to volitionally exit the hatchery; remainders are forced out.
- Both yearlings and sub-yearlings from the Marblemount Hatchery are larger than their wild counterparts, as revealed by fish trapped at the WDFW screw traps at river mile 17 in the lower Skagit River.
- Surplus adults have been out-planted into Baker Lake.
- The Skagit Hatchery spring chinook stock is treated as a single, "composite" Skagit River stock for providing index information.
- Adults are trapped volitionally from returnees back to the hatchery, approximately May 1 to August 15.
- Adults are spawned in August, at approximately 4,500 eggs per female or 450,000 eggs total.
- Adults are pair-spawned with a secondary (back-up) male added one minute after fertilization. This back-up male then becomes the primary male for the next female.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

Although this hatchery population was developed initially to serve as a back-up conservation stock for the Suiattle River, and subsequently to serve as a "composite" index stock for the Skagit River, the suitability of this hatchery stock for either purpose is questionable. This stock is propagated as a segregated hatchery population, and the degree to which it is representative of spring chinook salmon in the Skagit River is unknown.

B. Likelihood of attaining goals?

This program will most likely not be able to achieve the conservation goals initially intended for this population. In addition, it is unclear whether this segregated stock can adequately represent Skagit River spring chinook as an index stock.

C. Consistent with goals for other stocks?

A potential genetic risk to the wild Cascade River population may exist, but this risk is low because of the small number of hatchery-origin carcasses found in the Cascade River. There is some predation risk from released yearling spring chinook on wild summer chinook sub-yearlings in the Skagit River. This risk could increase if the hatchery program is expanded. Access to a harvestable surplus conflicts with goals for natural spring chinook stocks.

RECOMMENDATIONS

- Abandon a conservation purpose for this hatchery stock. The hatchery population has not been propagated in a manner consistent with conservation goals.
- Evaluate the benefits of this hatchery stock as an "index" stock for spring chinook in the Skagit River relative to the economic costs and biological risks of maintaining this program.
- Discontinue this program if the hatchery stock does not accurately represent spring chinook in the Skagit River, or if the benefits derived from its use as an index stock are minimal.

- Develop a contingency conservation plan for spring chinook in the Sauk and Suiattle Rivers, in case natural populations become depleted or decline significantly.
- Develop an integrated, index program from a new broodstock if the existing hatchery index stock is not representative of the wild populations in the Skagit River and if an index stock is clearly needed. Only start this new program if the wild stocks of spring chinook are strong enough to support it.

COMMENTS

- Out-planting surplus adults into Baker Lake could pose significant predation risks to sockeye salmon in that system.
- Expanding the existing program, with the goal of providing harvest opportunities, could pose unacceptable risks to natural populations of spring chinook.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but recognizes that program modifications will require consultation with the affected tribes.

Spring Chinook in Baker

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Intermediate
Population Viability	Critical	At Risk	Healthy
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	None	Occasional	Most Years
Hatchery Program:			
Purpose	Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

Fish for this program derive from six Sauk River tributaries and from Marblemount Hatchery adult returns from 1974–88. From 1981–88, eggs were also collected from marked and unmarked adults in the Cascade River. This stock is currently maintained by marked adult returns to Marblemount Hatchery. Skagit hatchery spring chinook are in the Stillaguamish and Skagit GDU. This program's goal is to determine if spring chinook can successfully be introduced into the Baker River. To that end, up to 2,000 adult spring chinook from the Marblemount Hatchery are supplemented into Baker Lake each year. An additional goal described for this program is nutrient enhancement of the upper Baker River. The program is planned to last for four years, ending with brood year 2002.

OPERATIONAL CONSIDERATIONS

- Adult fish are transported from the Marblemount Hatchery to Baker Lake.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The benefits are currently unknown, since this is a new program. There are potential benefits to the ecosystem through nutrient enhancement and potential conservation benefits to Skagit River spring chinook from expanding the natural spawning population. This would be consistent with the overall conservation goal for spring chinook in this system.

B. Likelihood of attaining goals?
The goal for this stock, in terms of a relatively small change to its biological significance and viability, is likely attainable. Long-term improvement of the stock's status will be dependent on the ability of the stock to adapt to the natural environment in the upper Baker River and improvement in the habitat's ability to support the stock.

C. Consistent with goals for other stocks?
There is a potential risk of predation by juveniles produced from this program, particularly on Baker

Lake sockeye. This program may therefore be inconsistent with the conservation goals for Baker Lake sockeye.

RECOMMENDATIONS

- Complete evaluation of the conservation benefit from this program.
- Select adults used for the program at random and to be representative of the entire return to the Marblemount Hatchery.
- Use returns to the Baker Trap for broodstock, if the program continues beyond 2002.
- Define the size of the adult supplementation program based primarily on the risk it poses to Baker Lake sockeye. Residualism rates for chinook, the size of the chinook population, and their predation rate on sockeye juveniles should be included in the risk evaluation.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Skagit River Hatchery Coho

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Intermediate	Intermediate	Intermediate
Population Viability	High	High	High
Habitat	Limiting	Limiting	Healthy
Harvest Opportunity	Most Years	Most Years	Each Year
Hatchery Program:			
Purpose	Indicator and Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Skagit coho program began in 1946 from wild fish collected on the Skagit and Cascade rivers (at approximately river mile 78). From shortly thereafter until the present day, this program has been maintained as a segregated stock by Marblemount Hatchery adult returns. The primary goal is to provide a tagged index stock for assessment of regional and distant (Canadian) fisheries. In addition to the 250,000 yearling coho reared and released on-station, 1,500,000 coho eggs are received from Wallace River and Minter Creek in the South Sound region, for rearing to 400 per pound, after which they are transferred to Skookumchuck Ponds for additional rearing, prior to final rearing and release from the South Sound Net Pens. 100,000 coho are reared for release at Indian Slough, in addition to other small net pen and classroom educational programs.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
This program is consistent with the goals and objectives. The conservation risks posed by this program to naturally-spawning salmon in the region are relatively small. Homing fidelity to the hatchery appears good, with minimal straying and interaction with wild adults on the spawning grounds.

B. Likelihood of attaining goals?
Past success suggests a likelihood of meeting objectives. However, a segregated hatchery stock poses some risk, especially in the long-term, for representing wild stocks as an index stock.

C. Consistent with goals for other stocks?
The only inconsistency with this program and its goals for other stocks is that the hatchery staff at Marblemount Hatchery is spread too thin.

RECOMMENDATIONS

- Manage this as an integrated, rather than segregated, hatchery program[26] if the intent is to maintain a coho index program. This assumes the stock origin and history allows the managers to phase in an integrated stock.
- Verify the assumption that the stock has maintained its integration with the natural Skagit coho stock. If it is incorrect, restart the program with new broodstock drawn from natural spawners and maintained through proper gene flow (incorporate an annual average of 10–20% naturally spawning fish in hatchery broodstock).

COMMENTS

- Given the complexity of programs at Marblemount Hatchery, staffing levels need to be reevaluated.

MANAGERS RESPONSE

WDFW understands the concerns raised by the HSRG regarding the potential divergence of the indicator stock and the natural stock. However, this divergence may not manifest itself in significant differences in catch distribution or harvest rates. If differences do exist, they may result as much from the rearing history, time and size at release as from the percentage of natural origin broodstock used in the program. For these reasons, WDFW suggests evaluating prior to program modification: a) the magnitude of the difference of the harvest rates and the catch distribution of tag groups of wild and hatchery origin coho salmon; and b) the costs and benefits of implementing an integrated program.

[26] *See HSRG Area-Wide Recommendation on operating integrated and segregated hatchery programs.*

Baker / Skagit Coho

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Intermediate
Population Viability	Critical	Critical	At Risk
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Most Years	Most Years	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

Baker River coho derive from adults captured in the Baker River trap beginning in 1924. This program is currently maintained by adult returns to the Baker River trap, which are spawned at Sulphur Creek Hatchery. Approximately 100,000 fry are released into Shannon Lake. 50,000 yearlings are also released (35,000 reared at Shannon and released in the Baker River; 5,000 released in Shannon Lake for the lower gulper efficiency tests; 10,000 released in Baker Lake for the upper gulper efficiency tests). Adult broodstock is collected from the 3,000–5,000 returning adults taken at the trap. Eggs are incubated, and fry are early reared, at Sulfur Creek. Yearlings are reared in net pens at Shannon Lake and trucked to the Baker River.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program provides a management tool to measure dam passage efficiency as a surrogate for sockeye smolts. However, it provides limited harvest and conservation benefits to the Baker River coho stock, because of the relatively small size of the program in comparison to the number of naturally-produced adults returning to the Baker Trap.

B. Likelihood of attaining goals?
The program is not likely to contribute to attaining either the harvest or conservation goals for this stock.

C. Consistent with goals for other stocks?
There are minimal predation risks associated with this program, because of its relatively small size.

RECOMMENDATIONS

- Rear only the number of smolts needed for the gulper efficiency tests.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendation of the HSRG.

Other Hatchery Coho

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[27]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

This program is used for cooperative projects in the Skagit region and relies on annual outplants from Marblemount Hatchery. The purpose of this program is to provide harvest and/or educational opportunity. To this end, coho are transferred in February for final rearing and release from saltwater net pens at Oak Harbor (30,000) and Roche Harbor (5,000). Another 100,000 coho are reared until February and transferred to Indian Slough (near La Conner). 1.5 million coho eggs are reared at Marblemount until the fish reach 400 per pound, at which time they are transferred for additional rearing with eventual release from the South Sound net pens. An additional 12,750 eyed eggs are transferred to miscellaneous cooperatives and schools.

OPERATIONAL CONSIDERATIONS

- The saltwater net pens receive yearling coho in February from Marblemount. The fish are then acclimated, reared and released mid-May.
- The Indian Slough fish are also transferred from Marblemount Hatchery in February, but are released without acclimation or additional controlled rearing.
- Eyed and green eggs are transferred in from Wallace River and Minter Creek in the South Sound region, for the South Sound Net Pens program.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The Skagit region net pens and Indian Slough releases are consistent with the goals, as are the educational programs with eyed eggs for schools and cooperatives.

B. Likelihood of attaining goals?
Continued harvest opportunity is expected from this program, along with an educational benefit. Higher survival rates on Indian Slough releases could probably be realized with a later release time.

[27] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

C. Consistent with goals for other stocks?
Straying from the net pens and Indian Slough could pose genetic risks to the critical viability of native stocks. However, the risk is a moderated because of the relatively small release numbers and relative low survival of Indian Slough releases.

RECOMMENDATIONS

- Discontinue rearing of coho destined for release in the South Sound at Marblemount Hatchery, in accordance with the HSRG's South Sound Regional Hatchery Review recommendations for the South Sound Net Pens.
- Release Indian Slough smolts in April or later to improve survival and harvest benefits.

COMMENTS

- Switching stocks for saltwater net pens and Indian Slough releases will provide two benefits. First, adult straying and mixing with wild adults from these releases will have less potential for negative genetic effects, since the Baker stock is an integrated stock as opposed to the segregated Marblemount Hatchery stock. Second, less workload on Marblemount Hatchery staff from this recommendation would allow staff more time to concentrate on other priorities.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Skagit / Baker River Sockeye

Puget Sound Energy and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	High	High	High
Population Viability	At Risk	At Risk	At Risk
Habitat	Inadequate	Limiting	Limiting
Harvest Opportunity	Most Years	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

The Baker River sockeye hatchery program began in 1896, but was discontinued in 1933 when the Baker Lake Hatchery on Silver Lake was closed, due to low returns. The program was reinstituted in 1957 with the artificial beach program. Baker River sockeye return to the lower Baker River, where they are trapped and transported above one or both dams to spawn in the protective custody of artificial beaches provided with gravel substrate and upwelling spring water. Up to 3,000 adults are allowed to spawn at beach four. An additional 550 spawners are placed at beach three, at the head of Baker Lake. Some surplus adults may be passed into Baker Lake, to spawn naturally in the lake tributaries. Fry from beach four are enumerated, collected and trucked to Baker Lake. Fry from beach three exit the beach directly into Baker Lake.

OPERATIONAL CONSIDERATIONS

- This program is operated by Puget Sound Energy (PSE) on behalf of WDFW, as part of a licensing agreement for the dams on Baker and Shannon lakes.
- IHN-V is the most significant disease risk during culture at the artificial spawning beaches. As adult spawners begin to die, the incidence of IHN rises. To avoid infecting eggs and juveniles, adult spawners are removed from the beaches during the later part of the run.
- The efficiency of the gulpers in both Baker and Shannon lakes remain a concern. Inefficiency in these collectors represents a potentially high risk to migrating juvenile sockeye. Furthermore, stranding of redds due to draw-down continues to affect overall population abundance and viability.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

Minimal harvest opportunity benefits are presently being attained. Hatchery intervention in the form of artificial spawning beaches has been adequate to maintain the stock at low but acceptable levels of abundance. In most years since 1990, the program has attained the goal of returning at least 3,000 spawners to the lake system and artificial beaches.

B. Likelihood of attaining goals?
Although the population is depleted, the stock has been successfully maintained, with little alteration of its natural life history pattern, since the inception of the program in 1957. Overall, the program is consistent with its harvest and conservation goals of maintaining a demographically viable, genetically intact population. Proposed changes in management, by confining spawners to a single artificial spawning beach, would substantially increase the demographic risk to the population from natural events like siltation, flooding and disease. There is a risk associated with the inability to properly sort returning adults at the Baker River Trap. There is a potential risk associated with the general lack of information on the hydrology, nutrient input, predation and food availability in the receiving waters of Baker Lake.

C. Consistent with goals for other stocks?
The goals for Baker River sockeye pose little or no threat to other indigenous stocks in the Baker River system and are consistent with the goals for other stocks and species.

RECOMMENDATIONS

- Refit, remodel or replace the trap on the lower Baker River, to accommodate the need for more efficient, less stressful sorting and handling of returning adults.
- Make vertical incubation trays at the beach four site a permanent feature of the program, to cloister and protect a reserve of eggs as an "insurance policy" against demographic losses due to IHN.
- Upgrade spawning channels with concrete dividers and bird netting, to reduce risk of disease transmission.
- Develop an additional water source, or increase reliability of the existing source, for the incubation and rearing systems at Sulphur Creek, in order to assure an adequate supply of silt-free water at that facility.
- Retain and upgrade beach three by protecting the beach from river migration and flooding. Address the problem of a declining flow of upwelling beach water.
- Move the rainbow trout release location to Depression Lake to remove potential sockeye predators from the main lake.
- Delay the opening of the kokanee fishing season, to protect out-migrating sockeye smolts.
- Devise a new strategy for distributing sockeye fry to upper Baker Lake, in order to avoid the concentration of predators and apparent high initial predation rate at the present release site. For example, use barges to scatter plant fry throughout the lake.
- Institute a comprehensive, limnological study to better understand the lacustrine habitat in which the juvenile sockeye rear. The HSRG envisions a multi-year study to investigate seasonal current flows, stratification, turnover rates, zooplankton, standing stock, predator/prey interactions and nutrient availability. A better understanding of the limnological processes in the lake system would provide managers with essential information on nutrient budgets, juvenile sockeye energetics and carrying capacity, and provide the scientific basis for whether a need exists to fertilize this heavily altered lake system. A two to three year limnology baseline study will be required before initiation of a fertilization program.
- Improve the mechanical operation of the gulper collectors. The HSRG understands that re-licensing discussions are underway that include modification to, or replacement of, the existing system. The group encourages the development of an innovative approach to the pressing problem of fish passage at the dams.

- Focus programs in the upper lake on the sockeye conservation program, and on efforts to improve and understand lake conditions, reduce predation and improve fish passage. Lake Shannon should become the focus of all other programs, such as net pen rearing of coho, and the recreational kokanee program.
- Incorporate flexibility into the new licensing agreement, to allow for adaptive management and the various studies and adjustments recommended above.[28]
- Do not introduce other stocks at Sulphur Creek Hatchery, due to potential transmission of disease from sockeye to these stocks.

COMMENTS

- The Baker Lake sockeye hatchery program is unique in the State of Washington. The spawning beaches represent the least invasive type of artificial propagation used to supplement wild populations.
- The program is operated as part of a specific license agreement. The HSRG is concerned that this prevents the program from being able to respond to changing fishery and conservation needs. Strong communication between PSE and the co-managers is extremely important.
- The program is an example of a hatchery program that has been successful in preventing the extirpation of a stock that would go extinct if present human intervention (trap, haul, and spawning beach activities) were suspended.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes:

- Modification of facilities and implementation of enhanced monitoring will require additional funding.
- WDFW has completed a microsatellite analysis of fish sampled from the Lake Shannon catch. The analysis indicates that fish of Lake Whatcom origin "were at most a very minor component of the harvest" (Sewall, Young, personal communication). WDFW will utilize this information as it reevaluates the artificial production and fishery management in this area.

[28] *See HSRG Area-Wide Recommendations on Flexibility, p. 7.*

Skagit / Shannon Lake Kokanee

Washington Department of Fish and Wildlife

Note: This program is not directed at an anadromous salmonid and therefore is not within the Hatchery Scientific Review Group's usual scope of programs to review. Therefore, it is described and discussed below only as it may affect Skagit/Baker River Sockeye with only comments—not recommendations—provided.

PROGRAM DESCRIPTION

Adult kokanee of Lake Whatcom origin are spawned at the Lake Whatcom Hatchery. 300,000 to 500,000 unfed fry from the Lake Whatcom Hatchery have been planted into Lake Shannon each year since 1989.

OPERATIONAL CONSIDERATIONS

- In 2001, 100% of the Whatcom fry planted in Lake Shannon were thermally marked, in order to identify their contribution to the kokanee fishery.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The harvest benefits of this program are largely unknown, as nothing is known regarding their survival or their contribution to Lake Shannon fisheries. It is possible that there are native kokanee still residing in the lake, or residualized anadromous sockeye, and that these are the major contributors to the fishery.

B. Likelihood of attaining goals?
It is not known whether the goals of this program are being met, because the fate of the released fry is unknown.

C. Consistent with goals for other stocks?
If a genetically unique population of indigenous kokanee exists in Shannon Lake, then over-planting with the non-indigenous, Whatcom Lake stock will have a detrimental genetic impact. If the planted fish survive, there is a risk of competition with migrating anadromous sockeye smolts. Additionally, there is a risk that large numbers of migrating sockeye smolts will be captured in the recreational fishery, as the present fishing season overlaps with the outmigration timing.

COMMENTS

- Consider suspending any planned planting program in the upper lake, pending outcome of the genetic analysis, due to the uncertain nature of the origin of Baker Lake kokanee.
- Consider delaying the fishing season in Lake Shannon, to avoid capture of migrating anadromous sockeye smolts.

- The fish captured in the recreational fishery are of unknown origin. Studies suggest that they are of four possible origins:
  1. They may be Lake Whatcom stock from years of planting unfed fry. Based on known susceptibility of the fry to IHN-V, it is unlikely that these fish survive to be recruited into the fishery.
  2. They may be Baker Lake stock. Strontium testing of kokanee in Baker indicates that the majority of their parents are of marine origin. No similar testing has taken place in Shannon Lake. Creeks in Baker Lake contain spawning kokanee.
  3. They may be a discreet resident population unique to Shannon Lake that may have a distant relationship to Baker sockeye or Whatcom kokanee. There are kokanee spawning in tributaries of Lake Shannon.
  4. Combinations of the above.
- Additional genetic studies are presently being carried out to determine the origin of the Shannon population, using mitochondrial DNA analysis. Significant differences exist between Baker sockeye and Whatcom kokanee. Similar analysis is underway for Shannon kokanee from creel census fish, as well as from Sulphur Creek spawners.

MANAGERS RESPONSE

WDFW has completed a microsatellite analysis of fish sampled from the Lake Shannon catch. The analysis indicates that fish of Lake Whatcom origin "were at most a very minor component of the harvest" (Sewall, Young, personal communication). WDFW will utilize this information as it reevaluates the artificial production and fishery management in this area.

Skagit River Chum

Skagit System Cooperative

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Intermediate	Intermediate	Intermediate
Population Viability	Healthy	Healthy	Healthy
Habitat	Limiting	Limiting	Healthy
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Education and Cultural		
Type	Integrated		

PROGRAM DESCRIPTION

The Skagit chum program began 1990. Adults are collected annually, but not necessarily throughout the run. Adult broodstock for this program (250 pairs) is collected by tangle net from Skagit River spawning grounds (river mile 40–44). Spawning, incubation, and early rearing take place at the Red Creek Hatchery. The chum fry (about 500,000) are then reared at the Swinomish Raceways, before being released into Swinomish Slough. The co-managers identify three chum stocks in the Skagit River—Skagit mainstem, Sauk, and Finney Creek (a lower Skagit tributary). This program is a component of the Skagit mainstem stock. Skagit chum belong to the Northern Puget Sound fall-run GDU. There are eleven chum stocks in this GDU.

OPERATIONAL CONSIDERATIONS

- During years when the run is low, adults may be collected during the entire run. However, in years when the run is abundant, adults may be collected only two or three times.
- In 1997, when there was a record low adult return, smolts were planted directly into the Skagit River near Sedro Woolley.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The primary purpose of this program is educational. The program also provides cultural benefits. A smaller program could probably meet these goals. The extent to which it also contributes to the short- and long-term harvest goals cannot be determined, due to a lack of data. Because of the small size of the program relative to the size of the naturally spawning component of the chum population, it probably has minimal impact on biological significance and viability goals for the Skagit chum stock.

B. Likelihood of attaining goals?

Goals for the Skagit chum population are already met under current conditions.

C. Consistent with goals for other stocks?
There is a potential concern about passage of juveniles and adults by the hatchery intake when flows are low, possibly affecting coho and cutthroat populations. Since Red Creek is an intermittent stream, these risks are small.

RECOMMENDATIONS

- Reduce program size to a level appropriate for an educational/cultural program.
- Improve fish passage by the hatchery intake. These improvements would require only a moderate investment and would provide both conservation and educational benefits.
- Enhance the educational and cultural values provided by this program. Consult HSRG operational guidelines for ways to improve the educational benefits.[29]

COMMENTS

- The HSRG felt this program was well justified on the basis of its educational/cultural value, especially if facilities were upgraded to better serve this purpose.
- If the program is changed to have a harvest purpose, data should be collected to evaluate contribution to harvest goals.

MANAGERS RESPONSE

No response received at time of publication. Check Hatchery Reform Project web site for responses received after publication date: www.lltk.org/hatcheryreform.html.

[29] *See HSRG Scientific Framework and Hatchery Review Program, chapter on Hatchery Operational Guidelines.*

Skagit River Hatchery Winter Steelhead

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[30]	Medium	Medium	High
Habitat	Limiting	Limiting	Healthy
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Skagit hatchery winter steelhead program began in the mid-1960s. Originally, this program was maintained through transplants from South Tacoma Hatchery (Chambers Creek stock). Final rearing occurred at Barnaby Slough ponds and the smolts were planted in the Skagit River. In the mid-1990s, the program changed and now is maintained by adult returns to Marblemount Hatchery and Barnaby Slough, and from marked fish returning to the Baker River Trap. Adults are trapped and spawned at both Marblemount Hatchery and Barnaby Slough. Fertilized ("green") eggs at Barnaby are transferred and incubated at the Marblemount Hatchery. 535,000 smolts are released (135,000 at Marblemount, 135,000 at Barnaby Slough, 172,000 at Grandy Creek and Fabors Ferry, 60,000 into the Baker River acclimation facility, 30,000 into the Davis Slough acclimation facility).

OPERATIONAL CONSIDERATIONS

- Fish are released May 1–15.
- Released fish are 100% adipose fin-clipped, with no coded-wire tags.
- If needed, adults or eggs from hatchery fish trapped at the Baker River Trap are transferred to Marblemount Hatchery.
- The management goal is to release 51% of the smolts in the lower river (below river mile 68) and 49% above in the upper river, to focus the sport fishery downstream of the primary bald eagle winter nesting and feeding areas.
- WDFW is tentatively planning to construct an acclimation and adult recapture facility at Grandy Creek, which is located at river mile 45.5, to further focus the sport fishery in the lower Skagit River.
- Harvest goals are 10,000 fish (5,000 for sport harvest, 5,000 for tribal harvest). The tribal goal is not being achieved, nor is it a priority, due partially to the low price currently paid for steelhead.
- The broodstock goal is to return 400 adults each to Marblemount Hatchery and Barnaby Slough.

[30] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

- Adults are trapped from December 1 to February 28 at both sites. Only clipped hatchery fish are used for broodstock. Unclipped (or wild) fish are rarely trapped before February 28.
- Eggs are fertilized in mixed gamete pools of five males and five females.
- Fertilized eggs are incubated in well water at Marblemount.
- After ponding, fish are reared on Clark Creek water at Marblemount and a mixture of spring and surface water at Barnaby.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
There are potential competition risks to wild winter-run steelhead, coho, and wild summer-run steelhead, but these risks appear small. Interbreeding of the hatchery stock with the naturally spawning stock is minimized by the differences in spawn timing. In general, the program appears to be highly successful at achieving harvest goals, especially sport fishery harvests, while minimizing impacts to wild populations.

B. Likelihood of attaining goals?
The program is achieving its goals.

C. Consistent with goals for other stocks?
Yes, but there are potential predation risks to pink and chum fry, and age zero-plus chinook. There is the potential for genetic interaction with naturally spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above.

RECOMMENDATIONS

- Implement Area-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- Use locally-adapted stock (of Chambers Creek origin) for those streams. Decrease reliance on other facilities (such as Tokul Creek or Bogachiel hatcheries) to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between May 1 and May 15, at target size of six fish to the pound, and a condition factor of less than 1.0.

- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.
- Investigate the reasons for the recent decline in adult winter steelhead returns, formulate a working hypothesis for the decline, and take appropriate actions.
- Develop an acclimation and adult trapping facility such as Grandy Creek for the lower river releases, at a site that reduces potential ecological and genetic interactions with wild populations.
- Establish the Sauk River as a wild steelhead management zone, with no releases of hatchery-origin fish.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A "white paper" on this topic could increase our understanding of HSRG concerns and recommended remedies.
- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.

WDFW supports the HSRG recommendation for improved monitoring, but notes that additional funding will be required.

Facility Recommendations

Assembled below are the Hatchery Scientific Review Group's recommendations that involve capital improvements at hatchery facilities in the Skagit region. Note that they include a series of alterations that may need to be made at Marblemount Hatchery. Future use of this facility will depend on evaluations and management decisions relating to the HSRG's recommendations to modify or discontinue several programs.

MARBLEMOUNT HATCHERY

- Upgrade pollution abatement ponds if they fail to meet water quality standards.
- Upgrade steelhead ponds for flood control purposes.
- Improve intake structures.
- Improve capability to enumerate out-migrating juveniles.
- Redevelop asphalt rearing channels.
- Provide fencing and upgrade bird netting to control predators.
- Reevaluate staffing levels, given the complexity of programs.

BAKER SPAWNING BEACHES

- Refit, remodel or replace the trap on the lower Baker River, to accommodate the need for more efficient, less stressful sorting and handling of returning adults.
- Make vertical incubation trays at the beach four site a permanent feature of the program, to cloister and protect a reserve of eggs as an "insurance policy" against demographic losses due to IHN.
- Upgrade spawning channels with concrete dividers and bird netting, to reduce risk of disease transmission.
- Develop an additional water source, or increase reliability of the existing source, for the incubation and rearing systems at Sulphur Creek, in order to assure an adequate supply of silt-free water at that facility.
- Retain and upgrade beach three by protecting the beach from river migration and flooding. Address the problem of a declining flow of upwelling beach water.
- Improve the mechanical operation of the gulper collectors. The Scientific Group understands that re-licensing discussions are underway that include modification to, or replacement of, the existing system. The group encourages the development of an innovative approach to the pressing problem of fish passage at the dams.

UPPER SKAGIT / RED CREEK HATCHERY

- Improve fish passage by the hatchery intake. These improvements would require only a moderate investment and would provide both conservation and educational benefits.

ACCLIMATION AND ADULT TRAPPING

- Develop an acclimation and adult trapping facility such as Grandy Creek for the lower river releases, at a site that reduces potential ecological and genetic interactions with wild populations.

❖Nooksack/Samish Rivers

Overview

This region includes the watersheds contained by the Nooksack/Samish River Basin. For the purposes of this review, the Scientific Group reviewed the hatchery programs involving each identified regional salmonid stock (for example, Nooksack North Fork/Middle Fork spring chinook). The review included a consideration of the program's effects on all other hatchery and naturally spawning regional salmonid stocks. This chapter provides an overview of the Nooksack/Samish region, followed by reviews and recommendations for each salmonid stock that has an associated hatchery program.

FISHERIES[31]

Early chinook, winter steelhead, pink, Samish coho, and chum salmon harvest management in the Nooksack/Samish region is directed primarily towards the needs of natural production. Fall chinook and Nooksack coho are managed primarily for hatchery production, with due consideration for increasing the productivity of natural production to the capacity of existing habitat. Pre-terminal harvests of hatchery and wild-origin fish occur primarily in Canada, Washington ocean fisheries, North Puget Sound, and in the Strait of Juan de Fuca. Terminal harvests on hatchery-origin coho, pink and chum occur primarily in Bellingham Bay and the Nooksack River. Terminal harvests on hatchery-origin fall chinook occur primarily in Bellingham Bay, the Nooksack River and Samish Bay.

Where possible, harvests are scheduled and located to target hatchery-origin fish and minimize the harvest of ESA-listed North, Middle and South Fork Nooksack chinook and other depressed stocks. There is no targeted terminal harvest of wild-origin, odd-year pink salmon because of its overlap in migration timing with protected, early, natural chinook returning to the Nooksack River. Sea-run cutthroat management is based entirely on natural production. Steelhead management targets the hatchery production of Chambers Creek stocks, with maximum protection to natural production of winter and summer stock.

CONSERVATION[32]

The tribes in this region face difficult decisions when balancing their cultural values relating to conserving the natural environment against their economic and cultural needs for adequate fisheries reserved by treaty. The tribes have participated in plans to increase natural production, but have been reluctant to reduce hatchery production until watersheds depleted by human development demonstrate a capacity to meet the needs of treaty fisheries.

All Puget Sound chinook are currently managed under the *Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component*, March 23, 2001. The intent of this plan is to maintain exploitation rates on natural chinook populations at or below levels that will allow them to

[31] *Provided by Darrell Mills, Washington State Department of Fish and Wildlife and Alan Chapman, Lummi Nation, November and December 2002.*
[32] *Ibid.*

rebuild, as habitat conditions improve to allow greater production. In 1981, a focused hatchery enhancement effort, to rebuild the North and Middle Fork Nooksack chinook population, was begun at the Kendall Creek Hatchery. Managers are using hatchery-enhanced returns of the native stock to re-establish the stock to the North and Middle Fork Nooksack. The *Puget Sound Salmon Management Plan* provides for fisheries to be managed as primary or secondary management units.

Nooksack/Samish coho fisheries are currently being managed in a status intermediate between primary hatchery unit (optimized to harvest all hatchery surplus production without harm to the natural stocks) and primary wild stock management (optimized to ensure escapements to maximum sustainable levels of future harvest). In many areas of Puget Sound, coho are managed under preliminary exploitation rate guidelines and escapement breakpoints from the co-managers' *Comprehensive Coho Management Plan*. However, at this time, no escapement breakpoints have been developed for natural production in the Nooksack Basin stocks or small streams entering Bellingham Bay. The low terminal harvest of Samish coho is incidental to directed fisheries on coho in Northern Bellingham Bay and the Nooksack River.

Natural origin chum have been managed for fixed escapement goals. Fisheries have been managed to exceed escapement goals in recent years, in order to develop better information on the productivity of the stock. The stated objective for odd-year pinks is for the expected natural spawning escapement to exceed the goal for the Nooksack River. In practice, it is difficult to selectively fish for Nooksack pinks during their co-migration with the North, Middle and South Fork native chinook.

The goal of regional winter steelhead management is to harvest the surplus production of the Chambers Creek-origin hatchery run, while avoiding harvest of naturally-produced winter and summer steelhead from the Nooksack and Samish Basins. In the absence of agreed-upon, co-manager escapement goals, and given the depressed state of natural production, no fisheries are directed on naturally-produced steelhead. Under the management strategy for sea-run cutthroat, minimum size limits were set so that the majority of females are allowed to spawn at least once. Harvest under this scenario is allowed only where stocks are thought to be healthy, and such harvest is consistent with management objectives.

HABITAT[33]

Nooksack River

The Nooksack River has three principle forks, each originating in the high slopes of the Cascade Mountains. Flowing westward through mostly steep, heavily forested terrain, the north and middle forks converge on a relatively broad valley floor about five miles upstream of the confluence with the south fork, to form the mainstem Nooksack River. Much of the south fork drainage is through mountainous and moderately forested terrain. However, in its lower reaches the stream flows through a broad, gently sloping valley to its confluence with the Mainstem Nooksack River. Below the confluence, the mainstem meanders northwest, west and then south, where it enters Bellingham Bay about four miles northwest of Bellingham.

There are 654 rivers and streams in the Nooksack drainage, providing 1,325 linear miles of stream in the independent drainages, mainstem Nooksack and its tributaries. Three of the basin's smaller independent drainages are located north of the Nooksack River system. The major portions of Dakota,

[33] *Provided by Alan Chapman, Lummi Nation, April 2002.*

California and Terrell creeks flow in a northwest direction through very gently sloping farmland. The headwaters of Dakota and California creeks are formed by springs and surface run off from moderately sloped, partially timbered hillsides, while Terrell creek has its origin in Lake Terrell and in the spring of Fingalson Creek. Dakota and California creeks enter Drayton Harbor. Terrell Creek enters Birch Bay. Five relatively small drainages flow directly into Bellingham Bay. These are Silver, Squalicum, Whatcom, Padden and Chuckanut creeks, all flowing in a generally westerly direction. Silver and Chuckanut are predominately surface run-off streams, while Squalicum, Whatcom and Padden creeks have their headwaters in lakes and enter the bay after passing through industrial areas in Bellingham. Each of these streams have slight to moderate gradients and each travels some distance through semi-residential or residential areas. Oyster Creek to the south originates in Lost Lake on Chuckanut Mountain and flows generally west over steep, moderately timbered slopes. The marine shorelines and estuaries so vital to the production of marine fish and shellfish include Drayton Harbor, Birch Bay, Lummi Bay, Bellingham Bay and Samish Bay.

For many streams in the Nooksack River system, steep sloped drainage basins create fast run-off conditions causing intensive early winter and spring flooding, followed by low summer flows. Heavy logging in the upper watersheds in the three forks has aggravated these run-off patterns. The falls on the north and south forks and Maple Creek eliminate 25 miles of mainstem river and eleven miles of good quality salmon streams. There is additional productive area above the barriers imposed by the middle fork diversion dam at river mile seven, and the falls/cascades sections of Glacier, Canyon and Skookum Creeks. Increased temperatures during the summer low flow periods and questionable water quality are prevalent in all lowland drainages, particularly in the lower mainstem Nooksack, its tributaries and the independent streams. Industrial discharges in the estuarial waters of Bellingham Bay degrade the habitat quality. Due to the season flash run-offs in the upper watersheds, there is extensive streambed shifting. Much of the suitable spawning substrate has washed downstream, leaving heavy boulders and rubble in areas of moderate gradient. Silt and mud deposits are extensive in many stretches of the slower, flat gradient, deeper waters of the mainstem Nooksack below the community of Everson. Small independent streams of the basin suffer from low summer flows and warm water temperatures above the tolerance of juvenile salmon.

Rural residential and commercial areas are expanding along the streams on the outskirts of Bellingham. Riverfront property development is now actively underway in the upper basin. These activities are causing increased demand for stream bed channelization and diking. Extensive agricultural activities in the northern part of the basin draw heavily on stream flows through irrigation withdrawals. Levee constructions and revetments, and other flood control measures, alter the natural stream environment through out the system.

Samish River

There are 85 streams in the Samish basin, providing over 215 lineal miles of drainage. Every tributary to the mainstem Samish River and Friday Creek presents some accessible area to anadromous fish, and many of the watercourses are inhabited by numerous resident fish stocks.

The Samish River originates near the Community of Saxon in the South Fork Nooksack Valley, and flows south for ten miles before entering into Warner Valley at river mile 18. Principal tributaries along this reach are Ennis, Thunder, Dry and Swede creeks. The Samish Channel, and a good portion of most of the tributaries in this section, wind across a relatively broad, gently sloping valley floor. Upper, steeper slopes of some tributaries are densely forested. Otherwise, streams encounter mostly cleared farmland with intermittent patches of deciduous growth. In the upper Samish River, there are two environmental types. Above Thunder Creek, the gradient is nearly flat and the stream slow

moving. There are some marshes, and the bottom is sand and small gravel. Stream widths range from 3–15', banks are stable and, for the most part, have good over-hanging cover. Below Thunder Creek at river mile 22, the gradient is moderate with good to excellent pool-riffle character. Widths range from 12–30 feet, carrying flows of 30–200 cubic feet per second. The bottom is clean gravel and rubble, with sand in pools. Most banks are naturally stable, offering gently sloping gravel beaches and some cut banks. There is only intermittent bank cover along this stretch.

The lower Samish River and Edison Slough drain into Samish Bay. The Samish River consists of 12 miles of mainstem and 35 total miles of tributaries. From river mile 12 about two miles east of Belfast, the Samish River flows west, turns south for a few miles and arcs north entering Samish Bay about one mile west of Edison. Five tributaries enter along this reach, the major ones being Friday Creek, the outlet of Lake Samish, and Thomas Creek. The Samish River and the major length of its tributaries flow over flat to moderately sloping agricultural land. Except for immediate stream bank cover, adjacent land is cleared for grazing or annual crops. Summer home construction is beginning along the upper tributary reaches.

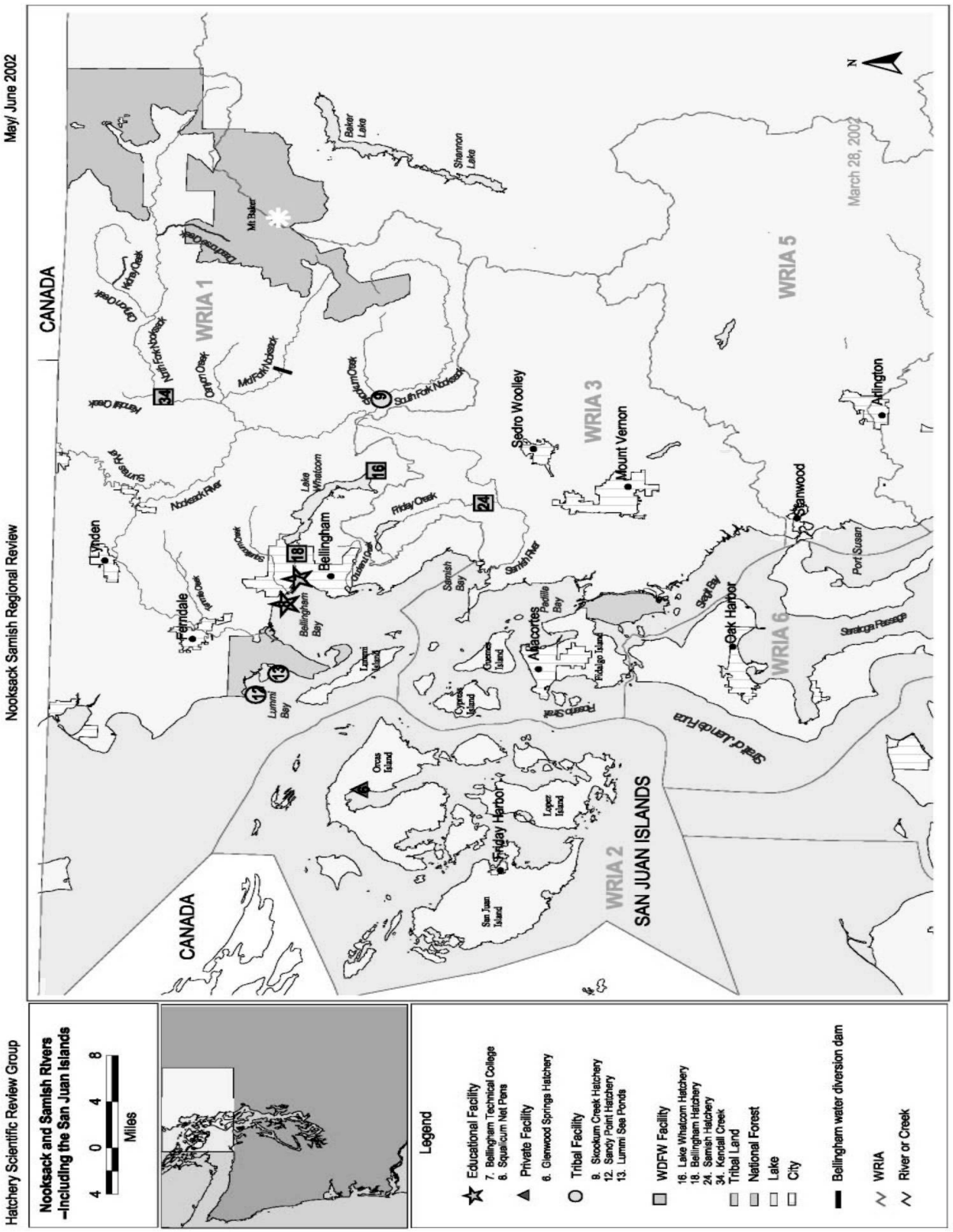
The mainstem Samish River offers two types of stream habitat. The lower half, with a flatter gradient, is predominantly a continuous, slow moving, moderately deep stream course 30–40 feet wide. Tidal influence extends upstream to river mile four, where the channel bottom is mostly sand and silt. Continuous dikes confine the river up to river mile five. Intermittent diking occurs between river miles five and 12. Most banks are cleared and steep sloped, having been stabilized by rip rap or artificial sloping. The channels upper section has a moderate gradient with a good riffle-pool balance. The bottom is mostly cleaned gravel and rubble. A few short sections of bank have been stabilized, but for the most part, the banks are naturally stable, consisting of gently sloping gravel beaches interrupted by occasional cut-banks. Relatively dense, deciduous growth provides nearly ideal shade and protective cover in this reach as well as along the upper tributaries.

Edison Slough was the old north fork Samish River. However, diking for flood control cut off this watercourse. The slough serves as a source of irrigation water, and a tide gate controls salt water intrusion. Salmon spawn in the main channel from river miles five to 12, and in the tributaries. They rear in all accessible sections of the drainage. The drainage is affected by low summer flows, removal of water for irrigation, stream bank clearance and bank stabilization projects. Water quality is affected by gravel mining, run-off from agricultural sprays, feed lots, silage pits and septic drainage. The sloughs have marginal water quality in the summer months.

Friday Creek is the largest tributary of the Samish River and contains over 14 miles of mainstem and 15 tributaries contributing an additional 40 stream miles. Friday Creek is formed by the overflow from Lake Samish. Seven small precipitous tributaries drain into this deep lake, forming the head water reservoir that controls the flow of the creek. From the lake outlet to river mile eight, the creek flows through heavily wooded, bottom land. Due to flooding, no residences are located until river mile six. Some residences and low intensity agriculture (grazing and garden crops) are found in the lower six miles. The lower mile of the creek is diked. The stream is bordered by deciduous and conifer trees in the lower six miles. Excellent spawning ground is found in the lower six miles, with more riffles than pools. From river miles six to eight, the stream meanders through a low gradient and gentle flows through agriculture and pasture land. The bottom is fine gravel and sand. The limiting factors in this drainage are low summer flows, high water temperatures, flooding, bank stabilization, logging and siltation. The surface waters of the lake exacerbate the summer high temperatures. There is a diversion dam for hatchery water supply at river mile 1.4, with fish passage facilities.

Habitat Improvement

Adherence to Timber/Fish/Wildlife Agreement rules should result in forest upland habitats improving in the long-term. Lowland habitat in agricultural areas should improve as the result of current efforts to improve stream buffers, dairy waste management, etc. However, urban areas will continue to expand, increasing impervious surfaces and storm water driven problems for streams.


Hatchery Scientific Review Group
Nooksack Samish Regional Review
May/ June 2002
Nooksack and Samish Rivers
–Including the San Juan Islands
4 0 4 8
Miles
Legend
Educational Facility
7. Bellingham Technical College
8. Squalicum Net Pens
Private Facility
6. Glenwood Springs Hatchery
Tribal Facility
9. Skookum Creek Hatchery
12. Sandy Point Hatchery
13. Lummi Sea Ponds
WDFW Facility
16. Lake Whatcom Hatchery
18. Bellingham Hatchery
24. Samish Hatchery
34. Kendall Creek
Tribal Land
National Forest
Lake
City
Bellingham water diversion dam
WRIA
River or Creek
CANADA
WRIA 1
WRIA 2
SAN JUAN ISLANDS
WRIA 3
WRIA 5
WRIA 6
March 28, 2002
N
Lynden
Ferndale
Bellingham
Lake Whatcom
Nooksack River
South Fork Nooksack
Middle Fork Nooksack
North Fork Nooksack
Mt Baker
Baker Lake
Shannon Lake
Sedro Woolley
Mount Vernon
Arlington
Stanwood
Port Susan
Skagit Bay
Oak Harbor
Strawberry Point
Samish Bay
Samish River
Padilla Bay
Fidalgo Island
Anacortes
Guemes Island
Cypress Island
Lummi Island
Lummi Bay
Bellingham Bay
Orcas Island
Lopez Island
San Juan Island
Friday Harbor
Strait of Juan de Fuca
Rosario Strait

STOCK STATUS[34]

Stocks	Hatchery Program?	Biological Significance (L=Low, M =Intermediate, H =High)			Population Viability (L=Critical, M = At Risk, H = Healthy)			Habitat (L = Inadequate, M = Limiting, H = Healthy)			Harvest Opportunity (0 = None, L = Occasional, M = Most years, H = Each year)		
			Goals			Goals			Goals			Goals	
		Now	Short-Term	Long-Term	Now	Short-Term	Long-Term	Now	Short-Term	Long-Term	Now	Short-Term	Long-Term
Glenwook Springs Hatchery Summer/Fall Chinook	Y	L	L	L	H	H	H	L	L	L	H	H	H
Lummi Bay Hatchery Summer/Fall Chinook	Y	L	L	L	H	H	H	L	L	L	H	H	H
Mainstem Nooksack Hatchery Summer/Fall Chinook	Y	L	L	L	M	M	M	L	L	M	H	H	H
Nooksack North Fork/Middle Fork Spring Chinook	Y	H	H	H	L	L	H	L	L	H	0	L	M
Nooksack South Fork Spring Chinook	N	H	H	H	L	L	H	L	L	H	0	0	M
Samish Summer/Fall Chinook	Y	L	L	L	L	L	L	M	M	M	H	H	H
Drayton/Bellingham Bay Ind. Tributaries Coho	N	M	M	M	M	M	M	M	L	L	L/H	L/H	L/H
Glenwood Springs Hatchery Coho	Y	L	L	L	L	L	L	L	L	L	H	H	H
Kendall Creek Coho	Y	L	L	L	L	L	L	M	M	M	H	H	H
Lummi Bay Hatchery Coho	Y	L	L	L	H	H	H	L	L	L	H	H	H
Skookum Creek Hatchery Coho	Y	L	L	L	H	H	H	M	M	M	H	H	H
Nooksack Coho	Y	L/M	L/M	L/M	M	M	M	M	M	M	H	H	H
Samish Coho	N	M	M	M	H	H	H	H	H	H	H	H	H
Squalicum Net Pen Coho	Y	L	L	L	H	H	H	L	L	L	H	H	H
Mainstem/South Fork Chum	N	H	H	H	M/L	M/L	M/M	L/L	L/L	M/M	H	H	H
North Fork Nooksack Chum	Y	H	H	H	H	H	H	M	M	H	H	H	H
Samish Chum	Y	M	M	M	M	M	M	M	M	H	L	L	M
Whatcom Creek Hatchery Chum	Y	M	M	M	M	H	H	L	L	L	H	H	H
Nooksack Even-Year Pink	N	H	H	H	M	M	M	L	L	L	0	0	0
Nooksack Odd-Year Pink	N	H	H	H	H	H	H	M	M	H	L	L	M
Whatcom Creek Hatchery Pink	Y	H	H	H	M	M	M	L	L	L	L	H	H
Independent Tributaries Steelhead	N	H	H	H	M	M	M	M	M	M	0	0	L
Nooksack Hatchery Winter Steelhead	Y	L	L	L	M	M	H	M	M	M	H	H	H
Nooksack Winter Steelhead	N	H	H	H	M	M	H	L	L	H	0	L	M
Samish Hatchery Winter Steelhead	Y	L	L	L	M	M	H	M	M	M	H	H	H
Samish Winter Steelhead	N	H	H	H	H	H	H	M	M	M	0	0	L
Whatcom Creek Hatchery Winter Steelhead	Y	L	L	L	M	M	H	L	L	L	H	H	H
Nooksack/Samish/Ind. Tribs. Sea-Run Cutthroat	N	H	H	H	M	M	M	L	L	M	H	H	H
Nooksack Bull Trout	N	H	H	H	M	M	M	M	M	H	0	0	L
Nooksack Riverine Sockeye	N	H	H	H	M	M	H	L	L	H	0	0	0

Biological significance *is determined by considering a number of specific factors relating to stock origin, biological attributes and population subdivisions, with the stock defined as being of either* low, intermediate *or* high *significance.*

Population viability *is determined by considering a number of specific factors such as age class structure, spawner escapement and proportion of hatchery-origin fish in natural spawning, with the stock's viability defined as being either* critical, at risk *or* healthy. *This rating refers to the stock's ability to sustain itself in the natural environment (except in the case of a segregated harvest program, in which case the ratings are* low, medium *and* high *and refer to the stock's ability to sustain itself in the culture environment).*

The stock's spawning, freshwater, migration and estuarine ***habitat*** *is rated as either* inadequate *(target stock is unproductive and the population will go extinct, even without terminal harvest),* limiting *(target stock is productive enough for the population to sustain itself at a low level terminal harvest) or* healthy *(productivity of the stock is high and the population is capable of growth and supporting significant terminal harvest).*

Harvest opportunity *is rated according to whether the goal is to provide* no *directed harvest opportunity,* occasional *opportunity, opportunity* most years*, or opportunity* each year.

[34] *This table contains ratings for all the salmonid stocks in the sub-region, as provided by the managers. For a more detailed definition of these ratings, see HSRG Scientific Framework and Hatchery Review Program, Benefit/Risk Tool chapter.*

HATCHERIES

Kendall Creek Hatchery[35]

WDFW's Kendall Creek hatchery is located on Kendall Creek, a tributary to the Nooksack River. The hatchery site, on Kendall Creek, is immediately upstream from the confluence with the north fork Nooksack River, at river mile 45.8. Kendall Creek Hatchery rears North Fork Nooksack spring chinook, Kendall Creek coho, Kendall Creek chum, Chambers Creek stock winter-run steelhead, Tokul Creek Hatchery cutthroat and Ford Hatchery brown trout. The facility is funded by the State General Fund.

There are four residences, two hatchery buildings (one old and one new), and a storage building. There is one gravity intake, one pump intake, and four wells. The new hatchery building uses vertical incubators. The old hatchery building, which is still used, has shallow troughs for starting rainbow and cutthroat trout. There are three, one-third acre asphalt ponds, 12 10' x 100' raceways, four 20' x 140' raceways, six 3' x 15' intermediate ponds, eight Capilano starter ponds with 75 cubic foot capacity, and a large, asphalt, adult trapping and holding pond.

Samish Hatchery[36]

WDFW's Samish Hatchery is located on Old Highway 99 north of Burlington. It is on Friday Creek, 1.4 miles from the confluence with the Samish River, at river mile 10.5. Samish Hatchery rears summer/fall chinook of Green River origin stock to provide a harvest opportunity in marine waters and in the Samish River.

There are two residences and a large hatchery building. The hatchery uses vertical incubators, twelve 20' x 80' concrete rearing ponds (these ponds are being replaced), and a one-half acre asphalt pond. There is a separate asphalt adult holding and rearing pond downstream from the hatchery, on the Samish River at river mile 10.4. Starting in the fall of 2002, there should be seven to eight 10' x 100' ponds to replace the eight 20' x 80' ponds.

Lummi Bay Hatchery[37]

The Lummi Bay Hatchery program has several components in and around the Lummi Bay area on Southeast Georgia Strait, in the Nooksack River Basin (WRIA 1), Sections 8, 9, 10 Townships Range 1 East, South of the Lummi River on the Lummi Reservation. It is associated with the 750 acre Lummi Sea Pond, a diked enclosure of the eastern shore of Lummi Bay with regulated tidal exchange. The goal of the facility's programs is to provide harvestable chinook and coho salmon, in a manner which does not impede the recovery of listed stocks or conflict with other treaty right fisheries objectives, to support Lummi treaty right fisheries around the reservation that have been adversely affected by habitat degradation in the Nooksack watershed since treaty times, and conforms with the obligations set forth in US v. Washington. The Lummi Bay Complex is owned by the Lummi Nation and is operated with funds appropriated by the Lummi Indian Business Council (LIBC) to the Lummi Natural Resources Department, originating from the US Department of the Interior and various grant sources.

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[35] *Provided by Darrell Mills, Pete Castle, Ted Thygesen, Washington State Department of Fish and Wildlife, April 2002.*

[36] *Ibid.*

[37] *Provided by Alan Chapman, Lummi Nation, April 2002.*

The Lummi Bay Sea Ponds Complex on the southern dike has four buildings—the main office, a pole building for storage, a powerhouse, and a spawning shed. There are four 40' diameter, circular, concrete rearing ponds; two 80' x 18' concrete burrows raceways; two one-third acre dirt ponds; and two 8,000 cubic foot net pens. A fish way through the tidal gate on the southwest corner of the dike leads to a 40' x 40' concrete holding pond with a fencing network for the capture and processing of brood stock. There is a spawning shed adjacent to the concrete circular ponds, where brood stock is kept. The main building once contained an incubation room, filtration and re-circulating water systems and laboratory space. Associated with the facility is a water pumping station on Kwina Slough of the Nooksack River, transmission pipelines and a storage reservoir on Chief Martin Road. Part of the facility is now being used for marine fish research by the Northwest Indian College.

The Sandy Point Incubation Facility is located in a 56' x 31' pole building, adjacent to the Lummi Nation Sandy Point Sewage Treatment facility, 300 yards inland from the Strait of Georgia near Sandy Point. It was constructed in 1991 to provide an improved incubation environment, without the limitations imposed by the Nooksack River water source at the main facility. There are 1,736 square feet of sheltered floor space. It has an auxiliary generator and a 25,000 water storage tower associated with its independent well supply. Part of the facility is currently being used for experimental work by the Northwest Indian College.

Skookum Creek Hatchery[38]

The Skookum Creek Hatchery is located along the south fork of the Nooksack River at river mile 14.3, just downstream of the confluence with Skookum Creek. The facility is located on approximately twelve acres owned by the Lummi Nation. The hatchery operations are funded by LIBC appropriations to the Lummi Nation Natural Resources Program, which receives its funding from the US Department of the Interior and various grant sources. The primary goal of the facility is to efficiently produce adult coho to support treaty right fisheries in and around the Lummi Reservation, and to mitigate for lost production due to habitat degradation in the basin since treaty times. A secondary goal is to provide additional harvest opportunity for other fishers in the terminal area and meet production obligations under the Pacific Salmon Treaty. Additionally, coho of the same generic stock returning to the Lummi Bay Facility are transported to this facility for hatching and subsequent rearing.

The facility consists of one separate residence, a combined residence and incubation facility, a workshop and a spawning shed. A 50 x 70 foot concrete pond holds the returning adults. The spawning shed is a pole structure located adjacent to the broodstock collection pond. The incubation facility is housed separately from rearing and spawning facilities. It consists of two large rooms with duplicate plumbing and equipment. Incubating trays can hold 320,000 green eggs. Well water is circulated through the trays and exits below. Fry are initially transferred to one of twelve raceways (90' x 10' x 3'). The coho are transferred at 250–300 fish per pound to one of four 50' x 325' asphalt-lined, rearing and acclimation ponds.

McKinnon Pond[39]

McKinnon Pond is located on an unnamed outlet creek from Mosquito Lake, WRIA 01.0353, at river mile 4.75 on the south bank of the middle fork Nooksack River. It was built in 1986–87 by the local chapter of Trout Unlimited to rear and release winter-run steelhead into the middle fork Nooksack, to

[38] *Ibid.*

[39] *Provided by Darrell Mills, Pete Castle, Ted Thygesen, Washington State Department of Fish and Wildlife, April 2002.*

provide a recreational harvest opportunity. The first steelhead releases were in 1988. The pond site is leased from the US Forest Service. The current lease has been extended until 2003, at which time it will be up for review for another five-year lease.

The ~25' x 250' asphalt rearing pond was built entirely with volunteer labor. Its water supply is not secured by a water right. It is gravity fed via multiple collection pipes from a peat bog wetland. It operates on an average of 900 gallons per minute (two cubic feet per second) flow. Daily feeding and maintenance is coordinated by Trout Unlimited. Fish are supplied via the Kendall Creek Hatchery. Flows and space are adequate for more than the current 50,000 smolt release, but water flow and distribution limits the effectiveness of the rearing pond. A shallow and wide outlet channel necessitates trucking the fish from the pond to a point downstream for release.

Whatcom Creek Hatchery[40]

Whatcom Creek hatchery is located on Whatcom Creek, which flows from Lake Whatcom, at river mile 0.5, at the base of the first set of falls. Bellingham Technical College, the local regional enhancement group (Nooksack Salmon Enhancement Association), the City of Bellingham Parks Department, state Aquatic Lands Enhancement Act funds, and WDFW fund Whatcom Creek Hatchery. Whatcom Creek Hatchery rears Nooksack River pink, Kendall Creek coho, Kendall Creek chum, and Chambers Creek stock winter-run steelhead.

There are two hatchery buildings (one old and one new one attached to the main building), a storage building, a feed shed, and a generator shed. There is one gravity intake that supplies all of the water to a settling pond. Fish ponds are gravity fed and a hatchery pump supplies the water to the hatchery building from the settling pond. Salt water influences the creek up to the facility, and fish can swim into the holding pond at low tide levels. The hatchery buildings use vertical incubators and have shallow tanks for handling eggs, four round tanks and a raceway for starting small groups of fish. The outside ponds consist of two 60' diameter round ponds, and two irregular shaped ponds used for trapping adults and holding fish in the fall, and rearing fish in the spring.

Glenwood Springs Hatchery[41]

Glenwood Springs salmon hatchery is located on the eastern shore of East Sound, Orcas Island. The entire watershed on which the facility is located encompasses 300 acres of privately-owned land. The operating organization is Long Live the Kings. The watershed contains three springs that supply water to the hatchery and associated earthen rearing ponds, and the saltwater bay to which the fish return. There is one hatchery building with a gravity flow water system and small hydro turbine that generates electricity for the building. There are five earthen rearing ponds. There is a small fish ladder (less than 100') leading from the saltwater bay into a large (30' x 30'x 12') concrete pond supplied with both fresh and saltwater.

The primary goal of the Glenwood Springs is harvest augmentation for sport harvest in north Puget Sound and adjacent waters. Long Live the Kings' goals include evaluating the effects and components of natural rearing. Fish reared or handled include Glenwood Springs Hatchery summer/fall chinook, Nooksack/Glenwood Springs Hatchery coho, and Whatcom Creek Hatchery chum.

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[40] *Provided by Earle Steele, Bellingham Technical College; Darrell Mills and Ted Thygesen, Washington State Department of Fish and Wildlife, April 2002.*

[41] *Provided by Kathleen Hopper and Mike O'Connell, Long Live the Kings; Darrell Mills and Ted Thygesen, Washington State Department of Fish and Wildlife, April 2002.*

Glenwood Springs Hatchery Summer/Fall Chinook

Long Live the Kings and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[42]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Education		
Type	Segregated		

PROGRAM DESCRIPTION

Glenwood Springs hatchery summer/fall chinook derive from Green River origin fall chinook transplanted to Samish Hatchery in 1938 and Kendall Creek Hatchery in 1954. The Kendall Creek Hatchery program was discontinued in 1998, because of native chinook hybridization concerns. This program is maintained by adult returns to Samish and Glenwood Springs hatcheries. Samish fall chinook is one of about 25 stocks that belong to the south Puget Sound GDU. The purpose of this program is to provide for harvest and public education, while avoiding adverse interactions with other stocks. To this end, the program releases 500,000 sub-yearlings and 200,000 yearlings annually. This is a cooperative program conducted through the WDFW Volunteer Cooperative Fish and Wildlife Enhancement Program.

OPERATIONAL CONSIDERATIONS

- Glenwood Springs has no habitat for natural fall chinook production. It is strictly a terminal area for harvest of hatchery-produced salmon.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
This program is consistent with harvest goals and has provided significant educational opportunities and benefits.

B. Likelihood of attaining goals?
The program has provided harvest opportunities each year and is likely to continue to do so. It has served as a demonstration project for educational programs and has incorporated the concept of natural rearing in its operational protocols.

[42] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

C. Consistent with goals for other stocks?
The risk of straying from this program is low, since it is geographically isolated. The available coded-wire tag data demonstrates little straying.

RECOMMENDATIONS

- Coded-wire tag the fish frequently enough to monitor straying and the survival differences between sub-yearling and yearling release groups.
- Evaluate survival of the two release types and adjust the ratio to best meet goals (see HSRG Area-Wide Recommendations on yearling versus sub-yearling chinook).
- Modify spawning protocols to match HSRG Area-Wide Recommendations.
- Remove returning adults at a rate sufficient to not exceed the holding capacity of the adult pond. This will prevent straying (although normal operations result in little straying).

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG and intends to mark 100% of the fall chinook fingerlings and yearlings released.

Lummi Bay Hatchery Summer/Fall Chinook

Lummi Nation

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[43]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Cultural		
Type	Segregated		

PROGRAM DESCRIPTION

Lummi Bay hatchery summer/fall chinook derive from Green River origin fall chinook transplanted to Samish Hatchery in 1938 and Kendall Creek Hatchery in 1954. This program is maintained by adult returns to Samish Hatchery. Samish fall chinook are one of about 25 stocks that belong to the south Puget Sound GDU. 500,000 sub-yearlings are released into Lummi Bay from the Lummi Bay Tribal facility.

OPERATIONAL CONSIDERATIONS

- Few adults are trapped, or spawned, at the Lummi Bay facility.
- Releases from Lummi Bay were marked with coded-wire tags in the early years. The last year of that program, the tagged fish released in Kwina Slough and Lummi Bay had the same code. Beginning in 2001, all fingerlings were adipose fin clipped, and 100,000 were marked and tagged.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program appears to be consistent with the goal of providing harvest and cultural benefits to the Lummi Nation.

B. Likelihood of attaining goals?
The program has a high likelihood of achieving harvest goals.

C. Consistent with goals for other stocks?
Stray rates of returning adults to the Nooksack River are unknown. Some straying and genetic risks may exist to spring chinook populations in the Nooksack River, particularly those in the South Fork. However, these risks are not considered to be large. There may also be a by-catch risk to spring

[43] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

chinook during harvest targeting the early portion of the hatchery-origin, summer/fall chinook returns. However, marking/tagging of released fish only began with the 2001 releases, so straying information and evaluations are forthcoming.

RECOMMENDATIONS

- Do not increase the size of this program above the current release level (500,000) at Lummi Bay during on-going assessments of genetic and by-catch risks to spring chinook populations in the Nooksack River, particularly the South Fork population.
- Consider using an imprinting attractant during the final rearing phase of fall chinook at the Lummi Bay facility. The Lummi Nation is seeking to increase the attraction of adult fall chinook salmon back to the Lummi Bay facility. The HSRG recognizes that achieving this objective will be difficult.
- Replace or refurbish the raceways and ponds at Lummi Bay.

COMMENTS

- The biological significance and population viability of naturally spawning summer/fall chinook in the Nooksack River need to be determined. The program should be re-evaluated based on the results.

MANAGERS RESPONSE

No response received at time of publication. Check Hatchery Reform Project web site for responses received after publication date: www.lltk.org/hatcheryreform.html.

Mainstem Nooksack Hatchery Summer/Fall Chinook

Lummi Nation

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[44]	Medium	Medium	Medium
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Cultural		
Type	Segregated		

PROGRAM DESCRIPTION

Mainstem Nooksack hatchery summer/fall chinook derive from Green River origin fall chinook transplanted to Samish Hatchery in 1938 and Kendall Creek Hatchery in 1954. The Kendall Creek Hatchery program was discontinued in 1998 because of native chinook hybridization concerns. This program is maintained by adult returns to Samish Hatchery. Samish fall chinook are one of about 25 stocks that belong to the south Puget Sound GDU. 500,000 sub-yearlings from the Samish Hatchery are released directly into the lower mainstem Nooksack River, immediately below the Marine Drive Bridge.

OPERATIONAL CONSIDERATIONS

- This program cannot be operated as a truly segregated program, because the opportunity for effective broodstock removal does not exist.
- 400,000 of the 500,000 fish released are adipose fin-clipped only and are expected to spend two weeks or more in the Lummi Bay Tribal facility, though they were released in 2001 with no intermediate rearing at that facility (direct release from Samish Hatchery).
- 100,000 of the 500,000 fish released are coded-wire tagged and adipose fin-clipped. These fish are transferred from the Samish Hatchery to the Lummi Bay Tribal facility for intermediate rearing, prior to direct release into the Nooksack River.
- Marking/tagging began with the 2001 releases.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

No information is currently available on the harvest benefits derived from this program. The program provides cultural benefits to the Lummi Nation.

[44] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

B. Likelihood of attaining goals?
This program may have a low likelihood of achieving harvest goals. In contrast to the Lummi Bay releases, direct releases into the mainstem Nooksack River are expected to yield high stray rates and quick passage of returning adults past the release site, because of the lack of spawning habitat and adult recapture facilities in the mainstem Nooksack, thereby reducing potential tribal harvest access.

C. Consistent with goals for other stocks?
Direct releases of fall chinook into the mainstem Nooksack River may pose genetic risks to spring chinook populations, particularly to the South Fork population. Preliminary genetic data (one year only) indicate that an estimated 83% of natural origin smolts in the South Fork Nooksack River are the progeny of hatchery fall chinook of Samish/Kendall ancestry. One hypothesis is that the parental source of those fall chinook smolts is adult strays from the mainstem Nooksack releases. Evaluation of this hypothesis is in progress. Harvests targeting returning fall chinook adults from the mainstem releases may also pose by-catch risks to spring chinook populations in the Nooksack River.

RECOMMENDATIONS

- Conduct spawning ground surveys to determine the source and level of straying into the South Fork.
- Perform DNA sampling of juveniles to assess the reproductive contribution of fall chinook to the South Fork spring chinook population.
- Suspend this program for at least a generation and until its risks to the South Fork spring chinook population are understood and can be controlled, in light of the critical population viability status and high biological significance of that population.

COMMENTS

- WDFW has suggested the release of summer/fall chinook sub-yearlings into Whatcom Creek as a possible alternative to direct releases into the mainstem Nooksack River. The HSRG concurs that releases into Whatcom Creek could substantially reduce potential risks to spring chinook populations in the Nooksack River.

MANAGERS RESPONSE

No response received at time of publication. Check Hatchery Reform Project web site for responses received after publication date: www.lltk.org/hatcheryreform.html.

Nooksack North Fork / Middle Fork Spring Chinook

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	High	High	High
Population Viability	Critical	Critical	Healthy
Habitat	Inadequate	Inadequate	Healthy
Harvest Opportunity	None	Occasional	Most Years
Hatchery Program:			
Purpose	Conservation and Cultural		
Type	Integrated		

PROGRAM DESCRIPTION

This program is currently being changed. The program as reviewed by the HSRG in 2002 derived from North Fork Nooksack River wild spring chinook collected from 1980–82 and was maintained from adult returns to Kendall Creek Hatchery since 1982. North Fork Spring Chinook are the only population in the North Fork Nooksack GDU. The program included 1.6 million fingerlings (400,000 at Kendall Creek Hatchery; 200,000 outplanted into Middle Fork; one million into the North Fork acclimation ponds) and up to 500,000 unfed fry released from remote site incubators (RSIs) into the North and Middle Fork Nooksack River. Adult collection and eyeing occurs at Kendall Creek Hatchery for on-site releases, acclimation ponds and RSIs. There are three acclimation ponds: Deadhorse, Excelsior and Kidney Creek ponds. Releases strategies vary with site; the time of release has been determined by the area biologist.

OPERATIONAL CONSIDERATIONS

- Otolith marks are used to distinguish among eight separate lots.
- On-site hatchery releases are split between April (200,000 at 100 per pound) and June (200,000 at 80 per pound).
- Acclimation ponds are poorly funded and exist as a result of a well-organized and committed volunteer force.
- All fish returning to the hatchery are spawned prior to August 24. After that date, otoliths are read to exclude any fall chinook individuals.
- A significant number of individuals return to the spawning grounds. Releases from the ponds are well distributed among the naturally spawning population.
- Increased escapement spawning in the wild is not translating into increased natural-origin recruits (NORs). Recent average of NORs is 120 (most recently 240).
- Habitat conditions are poor, with very hard, compact gravel.
- High straying has been recorded into the South Fork, and South Fork chinook populations are genetically distinct from those in the North Fork. In the last two years, chinook of North Fork cultured origin mostly from the on-site releases have represented 55% and 32 %, respectively, of the total number of spawners in the South Fork.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

This project is successfully protecting the remaining genetic resources and increasing absolute numbers of North and Middle Fork Nooksack spring chinook, but has not significantly increased the number of natural origin recruits per spawner. Adequate numbers are being produced to seed the habitat. However, few if any natural origin recruits are being incorporated into the broodstock, increasing the risk of domestication. Acclimation ponds and RSIs may reduce the magnitude of this risk. Fry produced are larger than natural origin fry, potentially producing competition risk to these NORs. The April release from the Kendall Hatchery may not be fully migratory, and may pose a competition risk to the natural origin recruits. The program also contributes to a ceremonial and subsistence harvest.

B. Likelihood of attaining goals?

Reproductive success in the wild is low. This condition is likely to remain unchanged in the short term, until habitat conditions improve.

C. Consistent with goals for other stocks?

A large proportion of spawners in the South Fork are of North Fork origin. The exact origin of these spawners is unknown, but their presence represents a significant genetic risk to the South Fork population. The reproductive success of the North Fork spawners and the level of introgression between the North Fork and South Fork are presently unknown.

RECOMMENDATIONS

- Reduce the size of the North Fork program to reduce the actual number of strays from the North Fork to the South Fork, and increase opportunities for rebuilding the South Fork population. Resize the program to a level appropriate for reducing straying, while continuing to meet conservation goals for the North and Middle forks.
- Release migration-ready smolts to the extent feasible, to minimize ecological interactions with naturally produced juveniles. Methods for achieving this include the continued use of acclimation ponds and volitional release. Acclimation ponds may more closely mimic natural life history patterns and coloration, and locate fish higher in the watershed than on-site releases from Kendall Hatchery.
- Include adults collected upriver in hatchery broodstock, in order to get a better representation of the entire natural run.
- Develop a long-term, stock recovery plan that takes into account available fresh water habitat in the watershed, domestication risks to North Fork spring chinook, straying risks to South Fork spring chinook, and maintenance of effective population size. The plan should also evaluate the effectiveness of the release strategies described above.
- Continue genetic analyses to more accurately characterize spawning populations. Continue temporal and geographic sampling of smolts to estimate the genetic composition of out-migrants at varying times and locations within the watershed.
- Conduct an evaluation of the risk to spring chinook from incidental harvest in terminal fisheries.
- Include a trap if a fish ladder is installed on the Middle Fork. This ladder would provide a demographic benefit for this and other stocks, with an estimated 16% increase of new chinook habitat. A trap would increase the management options available in the future. It could also be used to manage disease risks to the Lake Whatcom stocks (see Lake Whatcom kokanee comments).

COMMENTS

- This program is the primary means of preserving the North Fork chinook stock, but seems to be "out in front" of habitat restoration. The program appears to be producing a larger population than the habitat can support at this time, potentially leading to the increased straying into the South Fork that has become a significant concern. The program is also larger than necessary to contain the risk of extinction.
- A comprehensive review of the status of the South Fork population and options for recovery is needed. An HSRG task team would be willing to assist the managers with this review. This review should include analysis of the release lots from the North Fork, to identify any particular release or treatment with a high proclivity for straying into the South Fork.
- Recent genetic data suggest that a high proportion of smolts of fall chinook-origin are present in the South Fork. Genetic analyses should continue, to more accurately define the origin and extent of this risk.
- The managers are to be commended for adaptively managing this program.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG and has reduced the size of the program to a release of 800,000 fish.

The Nooksack Tribe believes most of the recommendations of the HSRG make sense, but notes the following (see Appendix B for the Tribe's full response):

- Along with WDFW and the Lummi Nation, the Tribe has put considerable energy into evaluating and adaptively managing the Kendall spring chinook program. Through this, the Tribe has learned how much effort and cost it takes to accomplish adaptive management through data collection, analyzing the results, interpreting data and adjusting the program. The Tribe encourages the HSRG to more clearly emphasize the need to provide adequate funding for this.
- The Tribe is disappointed with the recommendation to include a trap with a ladder, if built, on the Middle Fork "to increase management options," while restoring passage for ESA-listed North/Middle Fork spring chinook and bull trout, as well as for steelhead and coho. The Tribes concerns are for impacts to ESA-listed fish when holding, handling and sampling them, costs to test and man any trap, logistics (for example accessing the site during winter weather), and for excluding wild salmon and trout from their habitat.

Lake Whatcom Kokanee

Washington Department of Fish and Wildlife

Note: This program is not directed at an anadromous salmonid and therefore is not within the Hatchery Scientific Review Group's usual scope of programs to review. Therefore, only comments with options for managing risks to the stock—not recommendations—are provided.

PROGRAM DESCRIPTION

The Lake Whatcom kokanee program began in 1907 with native adults from Brannian Creek, a tributary to Lake Whatcom immediately adjacent to the Lake Whatcom Hatchery. Adult returns to Brannian Creek, maintain this program. Fertilization and incubation of the eggs are done at the hatchery on Brannian Creek and Lake Whatcom water. To maintain a healthy population of native-origin kokanee in Lake Whatcom, a portion of the eggs is hatched at Whatcom Creek Hatchery, with the resulting progeny reared at (with little or no feeding) and released from the hatchery into Lake Whatcom (five million fry). The remaining eggs are incubated to the eyed stage at the hatchery and then shipped to nine other Washington state hatcheries, to support sport fishery needs in western Washington (7,830,000 eggs). If additional eggs are available, they may be shipped out-of-state (e.g., to California and Idaho).

OPERATIONAL CONSIDERATIONS

- To date, Lake Whatcom Hatchery kokanee have not been marked, so the extent to which the hatchery population interacts with wild kokanee populations in Lake Whatcom is unknown.
- Lake Whatcom kokanee are unique in having a history of freedom from reportable pathogens (e.g., IHN virus). This allows them to be shipped to other watersheds, without the risk of spreading these pathogens.
- Genetic analysis has recently occurred on Lake Whatcom kokanee but no comparisons have yet been done between this stock and Baker or Shannon Lake stocks, in the Skagit region.

COMMENTS

- Under the present management plan to reintroduce salmon to the upper watershed, the following actions could be pursued to reduce, but not eliminate, the threat of disease to this population:
  - Include an adult trap if a fish ladder is planned for passing salmon upstream of the water intake, so that upstream passage can be denied to salmonids that test positive for reportable pathogens (this would also benefit Nooksack Hatchery winter steelhead, see recommendations for that program).
  - Sample spawned-out carcasses of all species of salmon spawning in the Middle Fork Nooksack for the next several years, to determine if reportable pathogens are present. The resulting information, together with pre-existing information, could be used to determine the prevalence, if any, of IHN virus and other reportable pathogens in these species.
  - Work with the City of Bellingham to halt the piping of water from the Middle Fork Nooksack to Lake Whatcom during the time any species carrying a reportable pathogen is allowed

access above the water intake to spawn and during the period of hatching and fry emergence for that species. Water-borne titers of reportable pathogens, including IHN virus, are likely to be highest during these periods.

- Determine the smallest size at which kokanee juveniles become refractory to IHN virus infections. If a refractory stage occurs (and the assumption is that it does), a portion of the hatchery releases to Lake Whatcom could be made at this stage (perhaps one million fish). This approach should reduce the impact of the virus on the kokanee population, should the infection be contracted. If all the rearing of these fish cannot be accomplished in Brannian Creek water (because of low flows in summer), then a pathogen-free water source should be found to satisfy this need.
- Accelerate and intensify efforts to identify and develop other kokanee stocks that could satisfy some or all of Washington state's demand for kokanee eggs.

MANAGERS RESPONSE

WDFW generally supports the recommendations of the HSRG. A statewide inventory of potential alternatives to using Lake Whatcom kokanee is currently underway.

The Nooksack Tribe believes most of the recommendations of the HSRG make sense, but notes the following (see Appendix B for the Tribe's full response):

- The Tribe is disappointed with the recommendation to include a trap with a ladder, if built, on the Middle Fork "to increase management options," while restoring passage for ESA-listed North/Middle Fork spring chinook and bull trout, as well as for steelhead and coho. The Tribes concerns are for impacts to ESA-listed fish when holding, handling and sampling them, costs to test and man any trap, logistics (for example accessing the site during winter weather), and for excluding wild salmon and trout from their habitat.

Samish Summer/Fall Chinook

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability	Critical	Critical	Critical
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Integrated		

PROGRAM DESCRIPTION

Samish summer/fall chinook were derived from Green River origin fall chinook transplanted to Samish Hatchery in 1938 and Kendall Creek Hatchery in 1954. The Kendall program was discontinued in 1998 because of native chinook hybridization concerns. This program is maintained by adult returns to the Samish River rack. Samish fall chinook are one of about 25 stocks that belong to the south Puget Sound GDU. Four million sub-yearlings are released on-site from the hatchery's holding pond into the Samish River. 100,000 yearlings are released on site, with intermediate rearing at Kendall from May to October. One million fingerlings are transferred to the Lummi Tribe for release of 500,000 each into Lummi Bay and the mainstem Nooksack River.

OPERATIONAL CONSIDERATIONS

- Recent molecular genetic studies by WDFW indicate that significant genetic divergence now exists between this stock and the progenitor Green River stocks.
- Yearling intermediate rearing takes place at Kendall because of water quality/quantity problems associated with the Friday Creek water supply at Samish Hatchery.
- These water quality problems limit the ability to release fish at the optimal times.
- There are also disease problems at Samish Hatchery, particularly from enteric red mouth (ERM) disease.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program appears to be consistent with short- and long-term goals for the Samish River.

B. Likelihood of attaining goals?
Sub-yearling releases result in good survival and contribute regularly to harvest. These sub-yearling releases thus appear to be achieving harvest goals. The program is managed as an integrated harvest program. There is natural spawning in the Samish River. If this population is self-sustaining, it will provide the opportunity to maintain an integrated genetic stock by inclusion of natural-origin fish into

the broodstock as needed or desired. Surplus hatchery-origin adults are allowed to pass upstream and assist with maintaining a naturally spawning population. On the other hand, overall survival and contribution of yearling releases to the "blackmouth" fishery in Puget Sound appear to be low.

C. Consistent with goals for other stocks?

There appears to be no significant straying of these hatchery fish from the Samish River Basin. However, a by-catch risk to Nooksack River spring chinook may occur in fisheries targeting Samish River fall chinook. By-catch risks to spring chinook salmon from the South Fork Nooksack River are of particular concern.

RECOMMENDATIONS

- Adopt proactive management practices to address chronic disease problems at this facility, such as ERM vaccination and improved husbandry techniques.
- Terminate yearling releases from this facility.
- Review and evaluate rearing densities at the Samish Hatchery, in light of water quality problems.
- Recognize water quality problems at the Samish Hatchery during current redesign of the facility, and in future reprogramming. Meeting program goals will require an increase in ponding capacities and other means to address water quality problems and limitations. In particular, engineering and design of the new facilities should not rely on "standard" designs, but rather, must consider the specific biological requirements of the fish and the available water quality and quantity at the Samish Hatchery. Original designs and engineering specific to the hatchery may be necessary.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but:

- Notes that additional funding will be required to upgrade the facilities as recommended; and
- Wishes to clarify that this is a segregated program. As noted by the HSRG, no significant straying occurs outside of the Samish Basin.

Glenwood Springs Hatchery Coho

Long Live the Kings and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[45]	Low	Low	Low
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Education		
Type	Segregated		

PROGRAM DESCRIPTION

The Glenwood Springs coho program originated with Nooksack River Hatchery coho and is maintained by adult returns to the Glenwood Springs Hatchery trap. The purpose of this program is to provide for harvest and public education, while avoiding adverse interactions with other stocks. To this end, this program annually releases 100,000 yearling coho from Glenwood Springs and 10,000 fed fry from an educational cooperative. This is a cooperative program conducted through the WDFW Volunteer Cooperative Fish and Wildlife Enhancement Program.

OPERATIONAL CONSIDERATIONS

- Glenwood Springs has little habitat for coho production. It is strictly a terminal area for harvest of hatchery-produced salmon.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
This program is consistent with harvest goals and has provided significant educational opportunities and benefits.

B. Likelihood of attaining goals?
This program has provided harvest opportunities each year and is likely to continue to do so. It has served as a demonstration project for educational programs and has incorporated the concept of natural rearing in its operational protocols.

C. Consistent with goals for other stocks?
The risk of straying from this program is low, since it is geographically-isolated. The available coded-wire tag data demonstrates little straying.

[45] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

RECOMMENDATIONS

- Modify spawning protocols to match HSRG Area Wide Recommendations.
- Coded-wire tag the fish frequently enough to monitor straying and survival.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes that additional funding will be required to implement a tagging program.

Kendall Creek Coho

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability	Critical	Critical	Critical
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Indicator		
Type	Integrated		

PROGRAM DESCRIPTION

The Kendall Creek coho program began in 1950 with native Nooksack coho. In addition, Capilano (British Columbia), Clark Creek, Orcas Island, Green River, Samish, Skookum and Wallace stocks have augmented the Kendall Creek hatchery coho stock. This ceased in 1990. Adult volunteers (150 pairs) to Kendall Creek Trap from October to December maintain the present program.

OPERATIONAL CONSIDERATIONS

- Although 150 pairs are used each year, they are spawned in pools of five. Because as few as one male in each pool may contribute all of the successful fertilizations, this tends to reduce the effective population size to something less than 300.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
Risks to other stocks in the region (e.g., predation on early chinook fry) are low, due to the present program's small size. The purpose and benefit of the program is harvest, which the program achieves. Several hundred to a few thousand are taken in various fisheries, a large portion in Canada (as is true for other stocks in the region). A major benefit is as a wild stock index. Kendall Creek is the only double index, tagged coho stock in the region.

B. Likelihood of attaining goals?
High.

C. Consistent with goals for other stocks?
Yes.

RECOMMENDATIONS

- Monitor and evaluate the contribution of hatchery origin spawners to coho spawning in Kendall Creek, as well as the contribution of natural origin spawners to the broodstock.

- Adopt HSRG area-wide spawning protocols to maximize effective population size.
- Alter rearing protocols to optimize smolt quality (such as ration control to moderate parr growth, maximize pre-smolt growth, reduce jacking and enhance survival).
- Consider the cost-effectiveness of having two coho index stocks in the basin and whether program effectiveness could be improved by consolidation (the HSRG recognizes that this is the only double index stock).

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes that additional funding will be required to monitor and evaluate the contribution of hatchery origin spawners to Kendall Creek.

Lummi Bay Hatchery Coho

Lummi Nation

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[46]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The current program began in 1990 with Green River-origin, Soos Creek Hatchery eggs. This replaced a previous coho program at this facility, whose broodstock had to be reconstituted after the identification of VHS at the hatchery in 1989. Adult returns to Skookum Creek Hatchery and Lummi Sea Ponds maintain the current program. One million yearlings are released on-station after two to four weeks of acclimation to seawater. Returning adults are collected for broodstock at Lummi Bay in a trap (1,000–1,200 pairs), selected randomly throughout the run. Eggs are eyed at the Sandy Point Incubation Facility, hatched and reared at the Lummi Nation's Skookum Creek Hatchery. The stock is coded-wire tagged as a US/Canada index stock.

OPERATIONAL CONSIDERATIONS

- Adults return considerably earlier than coho return to Skookum Creek, despite being the same ancestral stock.
- Vibriosis is the most significant fish pathogen during the yearling estuarine rearing phase. Vaccination has occurred during truck transfer from freshwater to the seawater site, but beginning with the 2001 brood, fingerlings were vaccinated during marking, a short time before transfer.
- The stock returns predominantly as three year-old fish.
- The current spawning protocol is to pool green eggs from 10 females and fertilize them with pooled sperm from 10 males.
- All eggs are incubated in well water.
- All releases are coded-wire tagged or adipose fin clipped.
- Adult survival from 1988–98 ranged from 0.8%–9.2%.

[46] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
These fish provide a significant contribution to harvest in relative isolation from harvest of other stocks, and the program is therefore consistent with its goals. Potential risks from the program include whether released coho prey on chum and Nooksack spring chinook in the estuary. There may be potential straying, but coded-wire tag data show only minor straying to other hatcheries (three percent to Skookum Creek).

B. Likelihood of attaining goals?
The program attains its goal of coho harvestable in segregation from other stocks, with year-to-year variations probably associated with climate changes.

C. Consistent with goals for other stocks?
The program is consistent with goals for local, wild coho stocks as presently formulated by the co-managers.

RECOMMENDATIONS

- Adopt HSRG area wide spawning protocols, which are designed to prevent erosion of the genetically-effective population size.
- Administer Vibrio vaccine some time prior to transfer from freshwater (perhaps two weeks to one month), to strengthen the protection given to the fish from this vaccine.
- Size this program to a scale appropriate to the demand for harvest. The HSRG notes that the market value of coho and other Pacific salmon has declined significantly in recent years and demand is therefore reduced.

COMMENTS

- It would be valuable to know whether body size distribution in this non-selected stock differs from the distribution of size in the cousin stock at Skookum Creek.
- It would also be valuable to know if the earlier return timing at Lummi Sea Ponds reflects earlier ocean migration timing than the Skookum Creek stock, and how this relates to optimum management of harvest.
- The use of multiple pools of spawners (25 per bucket) tends to constrain effective population size. In the long term, it would be beneficial to use protocols closer to one-to-one mating.

MANAGERS RESPONSE

No response received at time of publication. Check Hatchery Reform Project web site for responses received after publication date: www.lltk.org/hatcheryreform.html.

Skookum Creek Hatchery Coho

Lummi Nation

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[47]	High	High	High
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The current program began in 1990 with Green River-origin, Soos Creek Hatchery eggs. This replaced a previous coho program at this facility, whose broodstock had to be reconstituted after the identification of VHS at the hatchery in 1989. The program is maintained from adult returns (1,000–1,200 pairs) to Skookum Creek Hatchery. A total of 1.5 million eggs are taken. One million yearlings are released on-station (a tributary of the South Fork Nooksack River). Adult collection, incubation and rearing are carried out on-station. The stock is tagged as a US/Canada index stock.

OPERATIONAL CONSIDERATIONS

- Adults for broodstock are all taken at Skookum Creek and are selected for large size throughout most of the run, then selected randomly near the end of the run. Only adults that migrate up Skookum Creek from the South Fork Nooksack are used as brood fish. The stock returns predominantly as three year-old fish.
- The spawning protocol is to pool green eggs from ten females and fertilize them with pooled sperm from ten males.
- All eggs are incubated in well water.
- Skookum Creek Hatchery also rears coho destined for release at the Lummi Sea Ponds, but maintains them in separate raceways, as a distinct sub-population.
- Smolts are released at 16–20 per pound. All are coded-wire tagged or adipose fin clipped. Release is volitional, over a period of two to three weeks.
- Cold water disease is the most significant fish pathogen. It is exacerbated and transferred horizontally through the serial reuse of raceway water. BKD also causes loss. VHS was diagnosed in the Lummi Bay stock held at Skookum Creek in 1989, resulting in the destruction of all eggs obtained from both broodstocks.
- The stock is of Green River origin. The replacement stock for VHS-destroyed eggs in 1989 was Wallace River Hatchery. Some fish were also imported from Kendall Creek Hatchery in 1998.

[47] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

- Adult survival in the period 1988-98 ranged from 0.9%–7.1%.
- Approximately five percent of Skookum Creek adults are known to stray to other hatcheries, mostly to the Lummi Sea Ponds. Less than one percent of adults stray to other regional hatcheries. An unknown number stray to the wild.
- Surveys in the watershed are presently underway to determine the character and origin of natural spawners. If a wild/hatchery mix is present, the program will change to an integrated program, to ensure the sustainability of natural production.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

This program provides significant harvest benefits and is valuable as a US/Canada index stock.

B. Likelihood of attaining goals?

The program has been successful in achieving its goal of segregated harvest, separate and distinct from wild populations in the Nooksack Basin. However, little is known regarding the status of any remaining natural coho populations in the South Fork Nooksack.

C. Consistent with goals for other stocks?

Because the hatchery releases large numbers of large smolts, the Skookum Creek coho may represent a predation risk to smaller, wild South Fork spring chinook. Predation may be somewhat mitigated by the hatchery practice of volitional release, because fish allowed to migrate at their own volition are more likely to exit the river and estuary more rapidly than those forced from the raceways.

RECOMMENDATIONS

- Regularly integrate natural spawners into the program if a wild/hatchery mix is found to be present in sufficient numbers. The HSRG believes that the value of the stock for US/Canada indexing is reduced by segregating it from any remaining wild fish.
- Conduct studies to determine predation rates on natural South Fork spring chinook juveniles, including predator/prey size relationships, and areas and times where significant predation is most likely to occur. Predation information will allow hatchery managers to program numbers, times and smolt size at release to best avoid unnecessary predation mortality of depleted natural South Fork spring chinook.
- Undertake a renewed effort to understand the genetic composition of remaining natural coho spawners in the South Fork Nooksack, and the impact, if any, that hatchery strays may have on the persistence and genetic integrity of these fish. The HSRG recognizes that there is a divergence of opinion on the value of residual South Fork Nooksack coho, and that these determinations will take time to accomplish.
- Formalize the selection program underway that seeks to increase the body size of returning adults, and monitor the effect of size-selection on survival of hatchery fish. To date, this directed selection program has been informal and not rigorously controlled.
- Adopt spawning protocols consistent with HSRG area-wide recommendations.
- Size this program to a scale appropriate to the demand for harvest. The HSRG notes that the market value of coho and other Pacific salmon has declined significantly in recent years and demand is therefore reduced.
- Replace broodstock production shortfalls with in-region stocks in the exceptional circumstances of a lost brood year, such as occurred in 1998. Do not use out-of-region stocks.

COMMENTS

- None.

MANAGERS RESPONSE

No response received at time of publication. Check Hatchery Reform Project web site for responses received after publication date: www.lltk.org/hatcheryreform.html.

Nooksack Coho

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low/Intermediate	Low/Intermediate	Low/Intermediate
Population Viability	At Risk	At Risk	At Risk
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Education		
Type	Integrated		

PROGRAM DESCRIPTION

The Kendall Creek coho program began in 1950 with native Nooksack coho. In addition, Capilano (British Columbia), Clark Creek, Orcas Island, Green River, Samish, Skookum and Wallace stocks have augmented the Kendall Creek hatchery coho stock. This ceased in 1990. Adult volunteers to Kendall Creek trap from October to December maintain the present program. In this program, less than 100,000 fry—fed and unfed—are released in remote site incubators and classroom programs. They are incubated at Kendall Creek.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program, because of its small size, presents low risk to other stocks and is consistent with the co-managers' goals for coho in the Nooksack River. The program provides a high benefit from education, as well as a potential benefit to restoration.

B. Likelihood of attaining goals?
High.

C. Consistent with goals for other stocks?
Yes.

RECOMMENDATIONS

- None.

COMMENTS

- The Scientific Group encourages WDFW in its efforts to use this program and others to evaluate the productivity of remote site incubators.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Squalicum Net Pen Coho

Bellingham Technical College and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[48]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Education		
Type	Segregated		

PROGRAM DESCRIPTION

The Kendall Creek coho program began in 1950 with native Nooksack coho. In addition, Capilano (British Columbia), Clark Creek, Orcas Island, Green River, Samish, Skookum and Wallace stocks have augmented the Kendall Creek hatchery coho stock. This ceased in 1990. Adult volunteers to Kendall Creek trap from October to December maintain the present program. 5,000 yearlings are released on-site into Squalicum Harbor. Adult collection, incubation and rearing prior to saltwater transfer are at Kendall Creek.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is consistent with the short- and long-term goals for education by teaching net pen culture at Bellingham Technical College. It is also consistent with the goal of contributing to coho harvest each year.

B. Likelihood of attaining goals?
Educational goals are being met. Fish produced in this program are making a small, annual contribution to coho harvest. A large harvest from this program will never be possible, because of the program's size.

C. Consistent with goals for other stocks?
Because of its small size, the program does not pose any significant risks to other stocks.

[48] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

RECOMMENDATIONS

- None.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

North Fork Nooksack Chum

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	High	High	High
Population Viability	Healthy	Healthy	Healthy
Habitat	Limiting	Limiting	Healthy
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

This program began in 1978 with broodstock from native North Fork Nooksack chum adults. Volunteer chum returning to the Kendall Creek Trap maintain the program. Kendall Creek chum are one of 12 stocks that belong to the North Puget Sound GDU. Eggs are collected from adults returning to Kendall Creek Hatchery. Egg incubation and fry rearing are done at the hatchery. 400,000 unmarked fry are force-released from the hatchery in May.

OPERATIONAL CONSIDERATIONS

- It is not known whether wild chum volunteer to the hatchery.
- Adults are selected randomly across the entire run without consideration of size, age or timing.
- Fry are released two weeks after the release of steelhead.
- At release, hatchery fry are larger than their wild counterparts.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The harvest benefit is likely to be constrained by the relatively small size of the program. A conservation benefit is also being compromised because the program is being operated in a segregated, rather than integrated, manner.

B. Likelihood of attaining goals?

There is currently minimal harvest benefit, but in the long-term the program may provide a harvest benefit as a broodstock source for Whatcom Creek Hatchery. In addition, the program provides eggs for schools. A conservation benefit is unlikely to be achieved unless the operation of the program is modified as recommended below.

C. Consistent with goals for other stocks?

The program is consistent with the goals for other stocks in the drainage system, as it poses no obvious threats to them.

RECOMMENDATIONS

- Discontinue program or convert it into a properly integrated program by following the steps below:
  - Establish a new broodstock using 100% natural origin adults.
  - Thereafter, introduce into the hatchery stock a sufficient number of adults from the naturally spawning population to avoid genetic divergence over time (an annual average of 10-20%).
  - Collect adult broodstock at a location most likely to include natural origin fish.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW has terminated this program as recommended by the HSRG.

Samish Chum

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Intermediate	Intermediate	Intermediate
Population Viability	At Risk	At Risk	At Risk
Habitat	Limiting	Limiting	Healthy
Harvest Opportunity	Occasional	Occasional	Most Years
Hatchery Program:			
Purpose	Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

This program began in 1978 with Samish hatchery eggs. Adult returns to Bellingham Technical College maintained this program through brood year 1998, when the program began a broodstock transition to North Fork Nooksack chum. Samish chum are one of eleven stocks that belong to the North Puget Sound fall-run GDU. 500,000 unfed fry are outplanted from Whatcom Creek Hatchery into the Samish River. Adult collection is at Whatcom Creek hatchery, eyeing is at Kendall Creek hatchery, and hatching is at Whatcom Creek. 525,000 eggs or juveniles are also provided to miscellaneous sites, including regional fish enhancement groups. This program is ending after the 2002 brood year.

OPERATIONAL CONSIDERATIONS

- Since this program is scheduled to end after the 2002 brood year, the program was not evaluated for consistency with goals or any operational considerations.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
B. Likelihood of attaining goals?
C. Consistent with goals for other stocks?
See above.

RECOMMENDATIONS

- Discontinue program, as planned.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW has terminated this program as recommended by the HSRG.

Whatcom Creek Hatchery Chum

Bellingham Technical College and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Intermediate	Intermediate	Intermediate
Population Viability[49]	Medium	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest, Conservation and Education		
Type	Segregated		

PROGRAM DESCRIPTION

This program began in 1978 with Samish Hatchery eggs. Adult returns to Bellingham Technical College's Whatcom Creek Hatchery maintained this program through brood year 1998, when the program began a broodstock transition to North Fork Nooksack chum. Eggs imported from Kendall Creek Hatchery in brood years 1999–2001 have been used to begin the transition. Two million fed fry are released on-station. Adult collection and eyeing currently occur at Kendall Creek. Hatching and rearing take place on-station. The program is in the developmental stage, with future adult collection planned from returns to Whatcom Creek Hatchery. The release number is the planned program size.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The primary goals for this program have been identified as harvest and education. A secondary goal has also been described, as a gene bank to ensure the long-term conservation of the Nooksack chum stock. The program is consistent with the short- and long-term goals for harvest and education. However, the Nooksack chum stock generally meets its escapement goal of 18,000 fish and has recently reached as high as 60,000 fish. This makes the need for a conservation program questionable.

B. Likelihood of attaining goals?
The program provides significant harvest benefits, particularly to the terminal area sport fishery in the vicinity of Whatcom Creek, and provides an educational benefit through the teaching of fish culture at Bellingham Technical College and through close ties with the Bellingham public schools. The size

[49] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

of the program also appears to provide fish far in excess of the needs of the sport fishery, allowing for a contribution to commercial harvest. This additional escapement also contributes to the educational goal by selling some portion of the excess returns to recover program costs and provide equipment for the program. The broodstock management plan described for this program does not include any plans to maintain the proper, long-term integration with the natural Nooksack stock necessary for a gene bank, conservation program. In fact, the managers describe this program as segregated. This program does not pose any significant risks to the naturally spawning Nooksack chum stock, as long as it maintains its planned segregation.

C. Consistent with goals for other stocks?
The program does not pose any significant risks to other stocks.

RECOMMENDATIONS

- Keep the primary focus of the program on meeting the educational goals of teaching good, progressive fish culture. Meeting harvest goals should be a secondary consideration. The program should not be considered as providing any long-term conservation benefits for Nooksack chum.
- Implement effective stock separation plans during the planned stock transition. This is extremely important.
- Strive to meet and teach the best operational practices, for the benefits of the students. Among others, the HSRG specifically suggests:
  - Implement and teach spawning protocols that maximize the effective population size of the stocks, rather than the current approach of pooling gametes (see HSRG Area Wide Recommendations).
  - Recognize the water quality limitations of the facility and their potential effect on pre- and post-release survival when sizing programs, and in loading incubators and ponds.
  - Reduce the reliance on prophylactic chemical treatments to meet production goals.
  - Establish and teach strict disinfection procedures, to prevent the transfer of pathogens between rearing containers and stocks.
  - Discontinue the practice of re-suspending accumulated fish waste and discharging it into the receiving water.

COMMENTS

- Operating this as an integrated program could provide a potential back-up conservation program benefit and reduce potential risks of straying. This would require a broodstock collection strategy that ensures an adequate number of founders, and a plan to prevent divergence from the natural Nooksack stock.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Whatcom Creek Hatchery Pink

Bellingham Technical College and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	High	High	High
Population Viability	At Risk	At Risk	At Risk
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Occasional	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest, Conservation and Education		
Type	Integrated		

PROGRAM DESCRIPTION

Fish for this program derive from wild fish collected in 1997 and 1999 from the Middle Fork Nooksack River. This program is maintained through adult returns to the Whatcom Creek Trap or, if necessary, adults seined from a Middle Fork Nooksack tributary. Whatcom Creek pink are one of two stocks in the Nooksack Pink GDU. Two million fry are released on-station. Adult collection is on-station (with the addition of sperm from natural spawners from the Middle Fork Nooksack River). Eyeing is at Kendall Creek Hatchery. Hatching and rearing take place on-station, at Whatcom Creek Hatchery.

OPERATIONAL CONSIDERATIONS

- A relatively small number of fish were used to found this program.
- Current spawning protocols involve pooling gametes.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is consistent with the short-term and long-term goals for education, but does not appear to be necessary to meet the harvest and conservation goals identified for this stock.

B. Likelihood of attaining goals?
There is an educational benefit that can be provided by raising a variety of species at the Bellingham Technical College facility. This program adds to the diversity of experience for the students, along with the experience they are gaining by rearing chum, steelhead and saltwater-reared coho.

The likelihood of this program providing harvest benefits is uncertain. Terminal area sport fisheries for pink salmon exist and provide a recreational benefit in other areas, but the planned size of this program, like the chum program, will likely produce adults far in excess of the number that can be used in a sport fishery. A commercial fishery is not likely to develop, because of the relatively low market value of pink salmon. It is also difficult to identify a conservation benefit that can be derived from this program. The Nooksack pink stock appears healthy, with escapements for the last ten return

years averaging approximately 90,000 fish and exceeding 200,000 on occasion. Additionally, the relatively low number of fish used to found this program and the spawning protocols being used add to the uncertainty of this program providing a long-term, conservation benefit for Nooksack pinks.

Water quality limitations at this particular facility provide an additional concern about the advisability of adding a program of this size to the existing programs. Although a thorough examination of facility use throughout the rearing period has not been done, it appears that the addition of this program may not be consistent with the recommendation to reduce pond loading and densities in other programs.

C. Consistent with goals for other stocks?
The program does not pose any significant risks to other stocks.

RECOMMENDATIONS

- Eliminate this program, the chum program, or scale back both programs, to fit the facility's water quality and pond space limitations.
- If this program continues, plan and operate it primarily to provide educational benefits and only secondarily to meet sport harvest needs.
- Do not consider this program necessary for providing long-term conservation benefits for Nooksack pink salmon.
- Strive to meet and teach the best operational practices, for the benefits of the students. Among others, the HSRG specifically suggests:
  - Implement and teach spawning protocols that maximize the effective population size of the stocks, rather than the current approach of pooling gametes.
  - Recognize the water quality limitations of the facility and their potential effect on pre- and post-release survival when sizing programs, and in loading incubators and ponds.
  - Reduce the reliance on prophylactic chemical treatments to meet production goals.
  - Establish and teach strict disinfection procedures, to prevent the transfer of pathogens between rearing containers and stocks.
  - Discontinue the practice of re-suspending accumulated fish waste and discharging it into the receiving water.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Nooksack Hatchery Winter Steelhead

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[50]	Medium	Medium	High
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

This program began in 1978 with Tokul Creek Hatchery (Chambers Creek origin) yearling transplants. The program has been augmented with eggs from Barnaby Slough, Marblemount and Bogachiel hatcheries. The objective of this program is to provide fish for harvest, while avoiding any adverse interactions with other local stocks. To this end, 100,000 eggs are incubated, reared and released on-station as yearlings. 50,000 sub-yearlings are transferred in October to McKinnon Pond on the Middle Fork of the Nooksack River, for cooperative rearing and release.

OPERATIONAL CONSIDERATIONS

- All releases are marked.
- McKinnon Pond was built by Trout Unlimited. Cooperative rearing occurs between WDFW, local school programs and Trout Unlimited volunteers. McKinnon Pond does not have adult collection capability.
- The program uses an HSRG-approved steelhead rearing and release process (release of yearling smolts between May 1 and May 15, at a target size of six to the pound and a condition factor of less than 1.0; see Area-Wide Recommendations).
- Early spawn timing of the hatchery stock minimizes genetic interaction with naturally-spawning winter steelhead.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is providing a valuable harvest opportunity. Interbreeding of the hatchery stock with the naturally-spawning stock is minimized by the differences in spawn timing.

[50] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

B. Likelihood of attaining goals?
There is a strong likelihood that program goals will continue to be met, although recent trends in adult returns are a concern (probably related to poor ocean conditions).

C. Consistent with goals for other stocks?
There is the potential for genetic interaction with naturally-spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above.

RECOMMENDATIONS

- Implement Area-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- The HSRG encourages the use of locally-adapted stock (of Chambers Creek origin) for those streams. Decrease reliance on other facilities (such as Tokul Creek or Bogachiel hatcheries) to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between May 1 and May 15, at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.
- Discontinue releases at McKinnon Pond, due to a lack of adult collection capability. Reinstitute releases if a fish ladder is installed on the Middle Fork and the capability to remove hatchery releases is incorporated into the ladder (see comments for Lake Whatcom kokanee).
- Investigate the reasons for the recent decline in adult winter steelhead returns, formulate a working hypothesis for the decline, and take appropriate actions.

COMMENTS

- Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes, should the need for such stocks arise.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A "white paper" on this topic could increase our understanding of HSRG concerns and recommended remedies.
- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.

WDFW supports the HSRG recommendation for improved monitoring, but notes that additional funding will be required.

The Nooksack Tribe believes most of the recommendations of the HSRG make sense, but notes the following (see Appendix B for the Tribe's full response):

- The Tribe is disappointed with the recommendation to include a trap with a ladder, if built, on the Middle Fork "to increase management options," while restoring passage for ESA-listed North/Middle Fork spring chinook and bull trout, as well as for steelhead and coho. The Tribes concerns are for impacts to ESA-listed fish when holding, handling and sampling them, costs to test and man any trap, logistics (for example accessing the site during winter weather), and for excluding wild salmon and trout from their habitat.

Samish Hatchery Winter Steelhead

Bellingham Technical College and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[51]	Medium	Medium	High
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

This stock was originally imported from South Tacoma stock. Releases presently occur from Kendall Creek Hatchery fish transferred to Whatcom Creek Hatchery. Significant stock transfers into the watershed have occurred historically from Skagit, Tokul Creek and Bogachiel hatcheries. The objective of this program is to provide for harvest, while avoiding any adverse interactions with local stocks. To this end, 35,000 yearling smolts are released into the Samish River at river mile ten after incubation and early rearing at Kendall Creek and seven months of rearing at Whatcom Creek.

OPERATIONAL CONSIDERATIONS

- All releases are marked.
- Fish are released directly into the Samish River without acclimation, and may not have sufficient time for imprinting. Thus, adult collection capability is lacking.
- The program uses an HSRG-approved steelhead rearing and release process (release of yearling smolts between May 1 and May 15 at a target size of six to the pound, and a condition factor of less than 1.0).
- Early spawn timing of the hatchery stock minimizes genetic interaction with naturally spawning winter steelhead.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is providing a valuable harvest opportunity. Interbreeding of the hatchery stock with the naturally spawning stock is minimized by the differences in spawn timing.

B. Likelihood of attaining goals?

There is a strong likelihood that program goals will continue to be met, although recent trends in adult

[51] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

returns are a concern and probably related to poor ocean conditions.

C. Consistent with goals for other stocks?
There is the potential for genetic interaction with naturally spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above.

RECOMMENDATIONS

- Implement Area-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- The HSRG encourages the use of locally-adapted stock (of Chambers Creek origin) for those streams. Decrease reliance on other facilities (such as Tokul Creek or Bogachiel hatcheries) to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between May 1 and May 15, at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component of both wild steelhead management zones and hatchery harvest streams.
- Investigate the reasons for the recent decline in adult winter steelhead returns, formulate a working hypothesis for the decline, and take appropriate actions.
- Discontinue releases into the Samish River, as part of the Wild Steelhead Management Zone for Nooksack/Samish region.

COMMENTS

- Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help ensure the availability of founding stocks for hatchery purposes, should the need for such stocks arise.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A “white paper” on this topic could increase our understanding of HSRG concerns and recommended remedies.

- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.

WDFW supports the HSRG recommendation for improved monitoring, but notes that additional funding will be required.

Whatcom Creek Hatchery Winter Steelhead

Bellingham Technical College and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[52]	Medium	Medium	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Education		
Type	Segregated		

PROGRAM DESCRIPTION

This program began in 1978 with Tokul Creek Hatchery (Chambers Creek origin) yearling transplants. The program has been augmented with eggs from Barnaby Slough, Marblemount, Bogachiel and Kendall Creek hatcheries. In the recent past, adult returns to Whatcom Creek Trap maintained the program. Yearling transplants from Kendall Creek currently maintain this program. If necessary, Kendall Creek receives eggs from Marblemount or Tokul Creek. The objective of this program is to provide harvest and educational benefits, while avoiding any adverse interactions with other local stocks. To this end, 5,000 yearling smolts are reared and released at the Bellingham Technical College Hatchery after early rearing at Kendall Creek.

OPERATIONAL CONSIDERATIONS

- All releases are marked.
- Adult collection capabilities exist.
- The program uses an HSRG-approved steelhead rearing and release process (release of yearling smolts between May 1 and May 15 at a target size of six to the pound, and a condition factor of less than 1.0).
- Early spawn timing of the hatchery stock minimizes genetic interaction with naturally spawning winter steelhead.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is providing a valuable harvest and educational opportunity. Interbreeding of the hatchery stock with the naturally spawning stock is minimized by the differences in spawn timing.

[52] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

B. Likelihood of attaining goals?
There is a strong likelihood that program goals will continue to be met, although recent trends in adult returns are a concern (probably related to poor ocean conditions).

C. Consistent with goals for other stocks?
There is the potential for genetic interaction with naturally spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above.

RECOMMENDATIONS

- Implement Area-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- The HSRG encourages the use of locally-adapted stock (of Chambers Creek origin) for those streams. Decrease reliance on other facilities (such as Tokul Creek or Bogachiel hatcheries) to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between May 1 and May 15, at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component of both wild steelhead management zones and hatchery harvest streams.
- Investigate the reasons for the recent decline in adult winter steelhead returns, formulate a working hypothesis for the decline, and take appropriate actions.

COMMENTS

- Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A “white paper” on this topic could increase our understanding of HSRG concerns and recommended remedies.

- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.

WDFW supports the HSRG recommendation for improved monitoring, but notes that additional funding will be required.

Facility and Regional Recommendations

Assembled below are the Hatchery Scientific Review Group's recommendations that involve capital improvements at hatchery facilities in the Nooksack/Samish region. Also included is a region-wide recommendation relating to chinook and coho stocks.

KENDALL CREEK HATCHERY

- Improve capability to pass adult fish upstream.
- Upgrade the well fields and distribution system.
- Upgrade the early chinook acclimation ponds.
- Improve predator controls.
- Construct a Middle Fork acclimation/de-stressing pond.

SAMISH HATCHERY

- Rebuild the fish ladders on Friday Creek and Samish River to facilitate upstream passage of naturally produced fish.
- Replace the screens on the Friday Creek intake to facilitate downstream passage of naturally produced fish.
- Create new raceways that recognize the facility's water limitations (poor quality water requires lighter density and flow index).

LUMMI BAY HATCHERY

- Replace or refurbish the raceways and ponds.
- Improve coho trapping pond lead and associated tide gate modifications.
- Install security/predator fencing around collection areas and outside holding and rearing facilities.

SKOOKUM CREEK HATCHERY

- Rebuild the raceways.
- Improve the Skookum Creek intake to preserve its integrity during storm events.
- Update the pollution abatement system to meet water quality standards.
- Improve the drainage system for the yearling ponds.
- Improve the facility's ability to enumerate releases and handle fish.

WHATCOM CREEK HATCHERY

- Develop the Georgia Pacific water source, from Lake Whatcom.

MIDDLE FORK NOOKSACK FISH LADDER

- Include a trap with this ladder, if it is built, to increase management options and manage disease risks to Lake Whatcom stocks.

CHINOOK AND COHO

- Develop and implement a comprehensive wild chinook and coho monitoring and evaluation plan for the region.

❖Central Puget Sound

Overview

This region includes the Puyallup River, Green River, Lake Washington, and East Kitsap Peninsula sub-regions. For the purposes of this review, the Scientific Group reviewed the hatchery programs involving each identified sub-regional salmonid stock (for example, Puyallup River spring chinook). The review included a consideration of the program's effects on all other hatchery and naturally spawning regional salmonid stocks (see tables below under Stock Status). This chapter provides an overview of the Central Sound region and each sub-region, followed by reviews and recommendations for each salmonid stock that has an associated hatchery program.

FISHERIES[53]

Chinook, wild winter-run steelhead, sockeye, pink and chum salmon harvest management in the Central Sound region is directed primarily towards the needs of natural production and secondarily for harvest of surplus hatchery production. Coho harvest management in Lake Washington and the Green River is directed primarily toward surplus hatchery production and secondarily toward the needs of natural production. Hatchery winter-run steelhead management is directed toward full removal of hatchery-timed fish, to minimize potential interactions with wild steelhead. Pre-terminal harvests of hatchery and wild-origin fish occur primarily in Canada, Washington ocean fisheries, the Strait of Juan de Fuca and mid Puget Sound. Marine terminal fisheries include recreational and commercial net fisheries in Management Areas 9, 10 and 11. Extreme terminal harvests on mixed hatchery- and natural-origin fall chinook, sockeye, coho and chum occur in Elliott Bay and the Green River, Lake Washington, Sinclair Inlet, Commencement Bay and the Puyallup River.

Significant freshwater harvests of chinook, coho, chum and steelhead occur in the Duwamish-Green, and Puyallup River systems. Where possible, harvests are scheduled and located to target hatchery-origin fish and minimize the harvest of depressed stocks. Terminal harvest of hatchery- and wild-origin White River spring chinook occurs incidental to a small, Puyallup Tribe ceremonial fishery that is incorporated into test fishery data. The Muckleshoot Tribe conducts a limited, directed fishery for White River chinook on the Muckleshoot Reservation. There is normally no targeted terminal harvest of Puyallup River odd-year pink salmon because of their overlap in migration timing with White River chinook. There is no targeted winter run steelhead fishery in the Puyallup River. Winter run steelhead are caught in the river as by-catch during the coho and chum fisheries. Summer-run steelhead harvest management in the Central Sound region is directed at harvest of surplus hatchery production in the Green River. Sea-run cutthroat management is based entirely on natural production and does not include any directed commercial fishery.

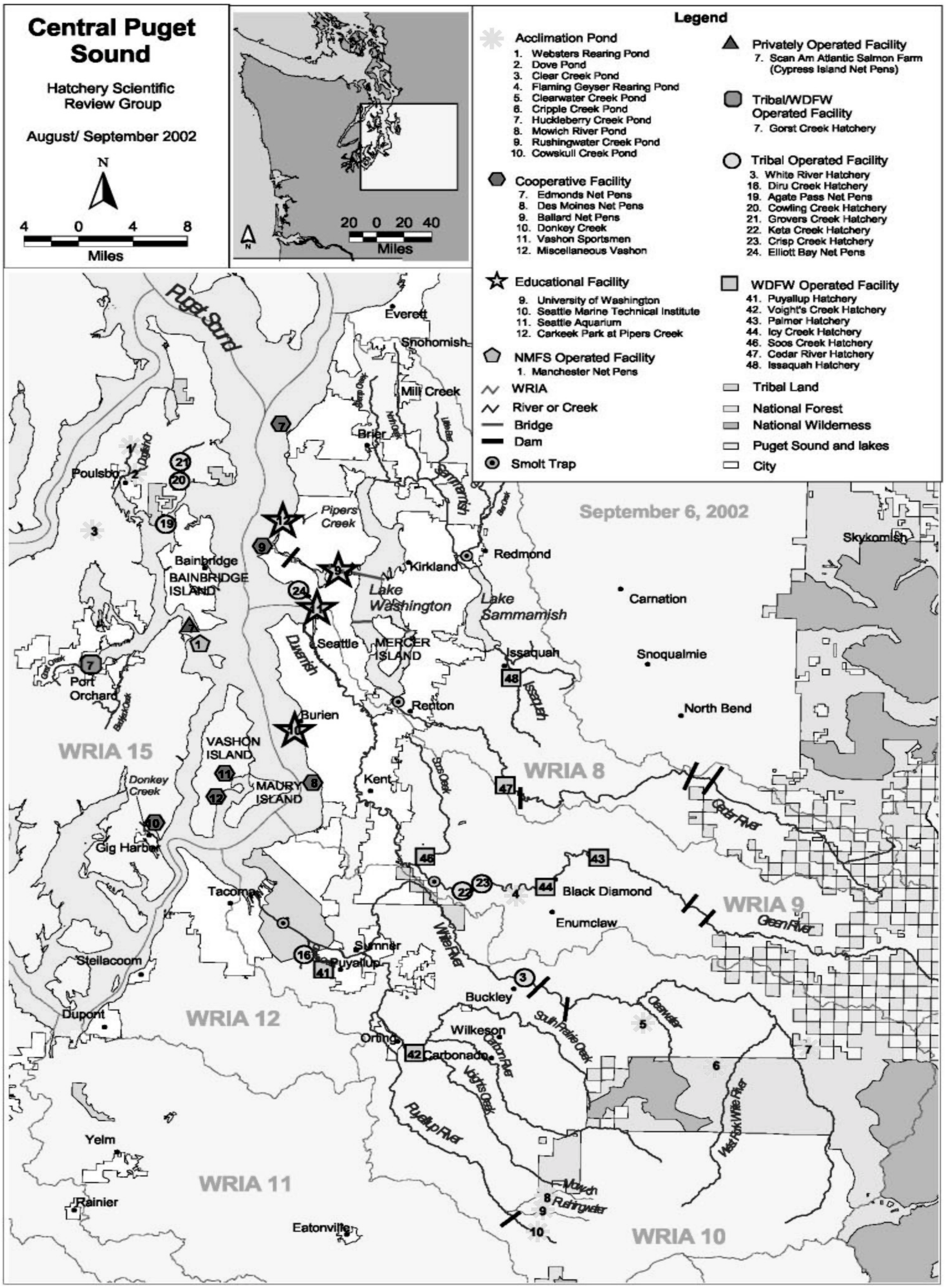
CONSERVATION[54]

All Puget Sound chinook are currently managed under the *Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component*, March 23, 2001. The intent of this plan is to

[53] *Provided by Darrell Mills, Washington State Department of Fish and Wildlife; Paul Hage, Muckleshoot Tribe; Chris Phinney, Puyallup Tribe; and Jay Zischke, Suquamish Tribe, November 2002.*
[54] *Ibid.*

maintain exploitation rates on natural chinook populations at or below levels that will allow them to rebuild if habitat conditions improve to allow greater natural production. In basins where habitat continues to degrade, hatchery production will continue to be necessary to maintain naturally spawning populations. All spring chinook hatchery enhancement efforts within the Puyallup River Basin are aimed at conserving the native White River stock. South Puget Sound coho stocks are currently managed to harvest surplus hatchery production under the co-managers' *Comprehensive Coho Management Plan*.

Natural-origin chum have been managed for fixed escapement goals, with different goals set for odd-year and even-year returns. Sockeye conservation and supplementation efforts are focused solely in the Lake Washington/Cedar River system and include both habitat enhancements and mitigated artificial production enhancements. Odd-year pinks are managed so that the expected natural spawning escapement meets or exceeds the goals for the rivers in the region. The goal of wild winter steelhead management is to consistently exceed the established escapement goal. Under the management strategy for sea-run cutthroat, minimum size limits were set so that the majority of females would be allowed to spawn at least once. Harvest under this scenario is allowed only where stocks are thought to be healthy and such harvest is consistent with management objectives.


Central Puget Sound
Hatchery Scientific Review Group
August/ September 2002
N
4 0 4 8
Miles
20 0 20 40
Miles
Legend
Acclimation Pond
1. Websters Rearing Pond
2. Dove Pond
3. Clear Creek Pond
4. Flaming Geyser Rearing Pond
5. Clearwater Creek Pond
6. Cripple Creek Pond
7. Huckleberry Creek Pond
8. Mowich River Pond
9. Rushingwater Creek Pond
10. Cowskull Creek Pond
Cooperative Facility
7. Edmonds Net Pens
8. Des Moines Net Pens
9. Ballard Net Pens
10. Donkey Creek
11. Vashon Sportsmen
12. Miscellaneous Vashon
Educational Facility
9. University of Washington
10. Seattle Marine Technical Institute
11. Seattle Aquarium
12. Carkeek Park at Pipers Creek
NMFS Operated Facility
1. Manchester Net Pens
WRIA
River or Creek
Bridge
Dam
Smolt Trap
Privately Operated Facility
7. Scan Am Atlantic Salmon Farm (Cypress Island Net Pens)
Tribal/WDFW Operated Facility
7. Gorst Creek Hatchery
Tribal Operated Facility
3. White River Hatchery
16. Diru Creek Hatchery
19. Agate Pass Net Pens
20. Cowling Creek Hatchery
21. Grovers Creek Hatchery
22. Keta Creek Hatchery
23. Crisp Creek Hatchery
24. Elliott Bay Net Pens
WDFW Operated Facility
41. Puyallup Hatchery
42. Voight's Creek Hatchery
43. Palmer Hatchery
44. Icy Creek Hatchery
46. Soos Creek Hatchery
47. Cedar River Hatchery
48. Issaquah Hatchery
Tribal Land
National Forest
National Wilderness
Puget Sound and lakes
City
September 6, 2002
Puget Sound
Everett
Snohomish
Mill Creek
Brier
Poulsbo
Pipers Creek
Bainbridge
BAINBRIDGE ISLAND
Kirkland
Redmond
Lake Washington
Lake Sammamish
Carnation
Skykomish
Seattle
MERCER ISLAND
Issaquah
Snoqualmie
Port Orchard
Renton
North Bend
Burien
WRIA 15
VASHON ISLAND
MAURY ISLAND
Donkey Creek
Kent
WRIA 8
Cedar River
Gig Harbor
Black Diamond
Tacoma
Enumclaw
WRIA 9
Green River
Sumner
Puyallup
White River
Steilacoom
Buckley
WRIA 12
Dupont
Wilkeson
Orting
Carbonado
South Prairie Creek
Puyallup River
Yelm
WRIA 11
Rainier
Eatonville
Mowich
Rushingwater
WRIA 10

PUYALLUP RIVER

Overview

HABITAT[55]

The Puyallup River Basin was one of the earliest areas of Puget Sound settled by Euro-Americans. They prized this basin for its deep-water embayment, large tracts of pristine old growth forests, fertile river valley soils and abundant runs of salmon. Homesteads and settlements began appearing as early as 1850 and the new arrivals initiated a series of actions to modify the landscape to fit their needs. Dredging and filling of the estuary started in the late 1800s and was largely completed by 1930. Two hydroelectric dams impassable to salmonids were completed shortly after 1900. An extensive system of levees, dikes and revetments were started in the early 1900s, and continue to be maintained today. In 1906, the White River was diverted into the Puyallup River Basin, almost doubling flows in the lower Puyallup River. All of these actions have affected the biological processes necessary for natural production of salmonids.

Today, the Puyallup River Basin has a population of over 241,500 in 14 incorporated communities and unincorporated Pierce and King counties, including the state's third largest city, Tacoma. The most extensive development occurs along the Interstate 5 corridor and along state routes that lead east and west from the Interstate. Extensive urban growth, heavy industry, a large, modern marine port, an extended revetment and levee system and agriculture have combined to significantly alter the natural landscape.

Commencement Bay, once a highly-productive estuarine environment, has lost more than 98% of its historical inter-tidal and sub-tidal habitat. The remaining habitat is separated and, in places, contaminated with chemicals that further reduce its value to organisms and their biological processes. The Puyallup, White and Carbon rivers are all contained within a revetment and levee system for their lower 26, eight and five miles, respectively. These channel containment structures have removed the natural sinuosity of the rivers and the spawning and rearing habitats that were once present. The two hydroelectric dams, and a later flood control project on the White River, have blocked salmon from their historical habitat and reduced their geographical distribution. Numerous other impassable barriers exist on smaller tributary streams that further reduce available spawning and rearing habitats. Land use practices have eliminated the opportunities for large and small woody debris recruitment and heavily affected riparian buffers.

The Puyallup Basin drains an area of approximately 1,065 square miles, has over 728 miles of rivers and streams that flow over 1,287 linear miles. Salmonid habitat in the Puyallup River basin is controlled by basin-scale characteristics including water quality and quantity, sediment sources and associated transport, aggradation and deposition, nutrient supply, and hydro-modifications.

The headwaters of the Puyallup, Carbon and White Rivers originate inside Mount Rainier National Park. Habitat in this area is considered quite pristine. The Mount Baker/Snoqualmie National Forest forms a ring around the national park. Outside this ring lies another ring of large, private, commercial

[55] *Water Resource Inventory Area (WRIA) 10 Limiting Factors Analysis, Washington Conservation Commission, John Kerwin, July 1999.*

timber landholdings (Weyerhaeuser, Rainier and Plum Creek timber companies) and state-owned timber lands that are managed for timber production, recreation and other uses. Moving westward, towards Tacoma, there is a mix of agricultural, residential, urban and industrial areas. The closer one gets to the Interstate 5 corridor and Tacoma, the higher the degree of development and industrialization.

Annual average rainfall in the basin ranges from 40 inches at the City of Puyallup to 70 inches at Electron Dam. Mountain snow pack has been recorded at up to 150 inches. Eighty percent of this precipitation occurs in the fall and winter months. Sixty percent of the Puyallup Basin lies at an elevation between 1,000 and 4,000 feet, an area where neither rain nor snow predominates. This topographical feature often leads to moisture conditions that are capable of generating tremendous amounts of runoff. These flood events normally occur in the winter months and are followed by less severe spring runoffs generated by snowmelt.

In spite of widespread habitat degradation within the Basin, there still exist functioning and productive areas. The South Prairie Creek sub-basin continues to be the backbone of natural salmonid production. Steelhead trout, chinook, pink, coho and chum all successfully reproduce within this sub-basin. The middle and upper reaches of the White River and associated tributaries have the potential to be highly productive if significant passage problems associated with the Lake Tapps Diversion Dam and Tacoma Water Pipeline in the lower reaches can be successfully addressed and riparian areas are allowed to recover. The upper Puyallup River sub-basin has the potential to naturally produce significant numbers of coho, steelhead and potentially a reintroduced spring chinook run if downstream smolt passage problems at the Electron Dam can be successfully addressed. Both the upper Puyallup and White rivers are predominantly within US Forest Service and private commercial timberlands. They have been afforded a certain amount of protection from the effects of urbanization and development, compared to urban areas in Puget Sound lowlands. However, both the upper Puyallup and upper White River watersheds suffer from present and past timber harvest practices that reduce the ability for riparian areas to provide wood and shade to the river and stream channels, and these continue to contribute fine sediments from road construction and landslides.

STOCK STATUS[56]

Stocks	Hatchery Program?	Biological Significance (L=Low, M =Intermediate, H =High)			Population Viability (L=Critical, M = At Risk, H = Healthy)			Habitat (L = Inadequate, M = Limiting, H = Healthy)			Harvest Opportunity (0 = None, L = Occasional, M = Most years, H = Each year)		
		Now	Goals		Now	Goals		Now	Goals		Now	Goals	
			Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term
Puyallup River Fall Chinook	Y	M	M	H	M	M	M	L	L	M	H	H	H
White River Spring Chinook	Y	H	H	H	L	L	M	L	L	M	L	M	H
Puyallup River Coho	Y	M	M	M	L	L	M	L	L	M	H	H	H
White River Coho	N	M	M	M	M	M	M	M	M	M	H	H	H
Puyallup River Chum	N	M	M	M	M	M	M	L	L	L	H	H	H
Diru Creek Hatchery Chum	Y	L	L	L	H	H	H	L	L	L	H	H	H
Puyallup River Pink	N	H	H	H	H	H	H	M	M	M	L	M	M
Puyallup River Winter Steelhead	N	M	M	M	M	M	M	L	L	M	0	L	H
Puyallup River Hatchery Winter Steelhead	Y	L	L	L	L	L	M	L	L	M	H	H	H
White River Winter Steelhead	N	M	M	M	M	M	M	L	L	M	H	H	H
White River Hatchery Winter Steelhead	Y	L	L	L	L	L	M	L	L	M	H	H	H
Puyallup/White Sea-Run Cutthroat	N	M	M	M	M	M	M	M	M	M	H	H	H
Puyallup/White Bull Trout	N	H	H	H	L	L	M	L	L	M	0	L	M

Biological significance *is determined by considering a number of specific factors relating to stock origin, biological attributes and population subdivisions, with the stock defined as being of either* low, intermediate *or* high *significance.*

Population viability *is determined by considering a number of specific factors such as age class structure, spawner escapement and proportion of hatchery-origin fish in natural spawning, with the stock's viability defined as being either* critical, at risk *or* healthy*. This rating refers to the stock's ability to sustain itself in the natural environment (except in the case of a segregated harvest program, in which case the ratings are* low, medium *and* high *and refer to the stock's ability to sustain itself in the culture environment).*

The stock's spawning, freshwater, migration and estuarine ***habitat*** *is rated as either* inadequate *(target stock is unproductive and the population will go extinct, even without terminal harvest),* limiting *(target stock is productive enough for the population to sustain itself at a low level terminal harvest) or* healthy *(productivity of the stock is high and the population is capable of growth and supporting significant terminal harvest).*

Harvest opportunity *is rated according to whether the goal is to provide* no *directed harvest opportunity,* occasional *opportunity, opportunity* most years*, or opportunity* each year.

HATCHERIES

Diru Creek Hatchery[57]

Diru Creek Hatchery is located on Diru Creek, a tributary to Clarks Creek in Puyallup, Washington. The Puyallup Tribe of Indians operates the facility with Puyallup Tribe and Bureau of Indian Affairs funding. The approximately two acre site consists of the hatchery, office, back-up generator buildings and hatchery manager's residence. Programs at the facility supplement tribal chum harvest and restoration of chinook in the Upper Puyallup River.

[56] *This table contains ratings for all the salmonid stocks in the sub-region, as provided by the managers. For a more detailed definition of these ratings, see HSRG Scientific Framework and Hatchery Review Program, Benefit/Risk Tool chapter.*

[57] *Information provided by Blake E. Smith, Puyallup Tribe, August 2002.*

Voights Creek Hatchery[58]

Voights Creek Hatchery is located on Voights Creek, a tributary to the Carbon River, which flows into the Puyallup River. The hatchery is on Highway 162, two miles east of the town of Orting and one half-mile from the confluence of the two rivers at Carbon river mile four. Voights Creek Hatchery is owned and operated by WDFW and financed through the State General Fund. There are two residences, one hatchery building, one storage/shop building and a freezer building. There is one gravity intake and a pump intake. The hatchery building utilizes vertical incubators. There are five 10' x 100' standard ponds, four 20' x 80' ponds, two asphalt 200' x 35' rearing ponds, one gravel 300' x 30' rearing/adult trapping pond, and four 15' x 3' starter ponds. Voights Creek Hatchery rears fall chinook, coho and steelhead.

Puyallup River Hatchery[59]

Puyallup River Hatchery is located at the head waters of Clarks Creek, a spring-fed tributary to the Puyallup River at river mile 5.75. The hatchery sits on 110 acres, in the city limits of Puyallup. The hatchery is owned and operated by WDFW and financed through the State Wildlife Fund. There is a duplex and a single residence, a hatchery building and a shop/garage/office building. There are two gravity intakes and one pump intake. The hatchery building uses vertical and shallow troughs. There are 16-40' round ponds, eight 10' x 80' raceways, six 10' x 100' raceways, two 10' x 130' gravel bottom raceways, and one 90' x 60' gravel bottom rearing pond (currently being used as a secondary settling pond for pollution abatement). Steelhead are reared from various stocks including, Bogachiel, Tokul Creek, and fish returning to the Voights Creek Hatchery.

White River Hatchery[60]

White River Hatchery is located in southeastern King County, three-fourths of a mile east of Highway 410, near the town of Enumclaw. The hatchery is adjacent to the White River and Puget Sound Energy's (PSE) hydro-diversion dam at river mile 24.3. There is one hatchery building, a generator building, surface water intake building, domestic water pump house and two residences. Water is supplied by six wells and a surface water intake system. There are four 8' x 95' x 3' concrete raceways, and one 96' x 52' x 4' concrete rearing pond. Within the hatchery building is the incubation room, containing 192 Heath Trays in 24 stacks of eight, and a start tank room with 16 intermediate 11' x 3' x 2' fiberglass tanks. The hatchery is funded and operated by the Muckleshoot Indian Tribe. The land and hatchery complex are currently owned by PSE.

[58] *Information provided by Brodie Antipa and Darrell Mills, WDFW, August 2002.*
[59] *Ibid.*
[60] *Information provided by Richard Johnson, Muckleshoot Tribe, November 2002.*

Puyallup River Fall Chinook

Puyallup Tribe and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	High
Population Viability	At Risk	At Risk	At Risk
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	High	High	High
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

This program began in 1917 with <100 adults from Voights Creek. Green River Hatchery chinook eggs and juveniles have supplemented this program. For the past 20 years, the program has been maintained with adult returns to Voights Creek Hatchery. Puyallup River fall chinook belong to the South Puget Sound, Hood Canal and Snohomish Summer and Fall GDUs. Two million fingerlings are released in the drainage (1.6 million on-station at Voights Creek, 180,000 on-station at Diru Creek Hatchery, 100,000 at Mowich Creek Acclimation Pond, 100,000 at Cow Skull Creek Acclimation Pond, 20,000 outplanted into Hylebos Creek). Since 1999, up to 1,000 surplus hatchery adult chinook have been given to the Puyallup Tribe to reintroduce above Electron Diversion Dam in the upper Puyallup watershed. Adult collection, spawning, incubation and rearing occurs on-station at Voights Creek. Adult collection and eyeing for Diru Creek and acclimation pond releases occurs at Voights Creek. Hatching and rearing for Diru Creek release and early rearing for acclimation ponds and Hylebos Creek outplants occurs at Diru Creek.

OPERATIONAL CONSIDERATIONS

- Since 1942, an average of 85% of fish released originated from Voights Creek Hatchery brood stock. All releases from the Diru Creek program since brood year 1988 have been Voights Creek Hatchery stock.
- The hatchery stock at Voights Creek has had three coded wire tag groups applied since 1988, the last being the 1997 brood year. The Diru Creek on-station release has had limited coded wire tagging in brood years 1984–86, 1997 and 2000–01. Acclimation pond releases have been coded wire tagged for brood years 1998–01. There are plans to continue coded wire tagging for four years for the on-station release, and five years for the acclimation pond release.
- Mass marking of the Voights Creek Hatchery stock began with the 1999 brood year (brood year 1998 was 50% marked).
- Contribution of hatchery origin returns to South Prairie Creek natural spawners is approximately 15%. Contribution of hatchery origin recruits to natural spawning populations is generally unknown elsewhere in the river system, because of limited visibility.
- Diru Creek returns are assumed to stray 100% because of lack of adequate attraction water.

- Contribution of natural origin recruits to the hatchery population is unknown.
- Comparative sizes of the hatchery and naturally produced juveniles are unknown.
- Juvenile passage issues constrain the short-term conservation program to reintroduce fall chinook above the Electron Dam.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
This program provides annual harvest consistent with the goal described, and apparent demographic benefits. The current conservation benefit of the program is questionable, because of uncertainties about the composition of the hatchery broodstock and the effect of hatchery straying on the naturally spawning component of the population.

B. Likelihood of attaining goals?
Both the historical and current contribution of natural origin fish to the hatchery broodstock is unknown. Since there has been no planned infusion of natural origin recruits into the hatchery broodstock, there is a risk that the hatchery component of this population has significantly diverged from the natural component. There is also a risk that because of long-term straying from the hatchery, the natural spawning component has been swamped by hatchery releases and is not currently adapted to the natural environment. This creates a risk of loss of viability from domestication to the naturally spawning component. Hatchery releases also create a potential risk of competition to naturally produced fall chinook.

C. Consistent with goals for other stocks?
There is a risk to the biological significance of White River spring chinook, due to potential introgression of genes from the fall chinook programs. The inability to correctly identify fall chinook at the Buckley Trap also poses a domestication risk to White River spring chinook, by restricting the use of natural origin recruits for that program. There is also a potential competition risk from this program to White River spring chinook juveniles. The lack of adequate pollution abatement facilities at both Voights Creek and Diru Creek may be adversely affecting the receiving habitat for chinook and other natural stocks.

RECOMMENDATIONS

- Continue adult releases for reintroduction above Electron Dam, to minimize domestication risks. This will require improved juvenile downstream passage at the Dam. Once this occurs, incorporate escapement needs for this element of the program into harvest planning, to ensure that fish are not available only when there is a surplus.
- Develop a long-term plan to naturalize the fall chinook population, both in the hatchery and on the spawning grounds above and below the Electron Dam.
- Manage this program to allow natural origin fish to drive adaptation, to the extent possible in these highly-urbanized watersheds. In order to do this, the goal should be for natural fish to constitute an average of at least two-thirds of the naturally spawning population.
- Determine the natural spawning escapement and its composition (hatchery- and natural-origin), and the number and composition of the resulting recruitment.
- Construct an acclimation and adult collection pond at Clarks Creek, with adequate attraction to reduce straying of fish released from Diru Creek.
- Implement rearing and release protocols that result in smolts that rapidly migrate during the normal outmigration period.

- Differentially mark fish from different release sites and strategies to evaluate survival and straying to the natural fall chinook component and the White River.
- Discontinue the pooling of gametes and adopt spawning protocols that maximize the effective population size of the hatchery component (see HSRG Area-Wide Recommendations).
- Consider semi-natural rearing, to increase survival and perhaps reduce domestication.
- Address the need for pollution abatement ponds, and adult holding and collection facilities.

COMMENTS

- Understanding the composition of the natural spawning population in a glacial stream may require development of a sampling plan that relies on methods other than visual observations, such as an estimate based on the change in ratio of marks by removal.
- A need exists to address two uncertainties: 1) whether natural reproduction is driven primarily by natural- or hatchery-origin adults; and 2) whether natural reproduction is self-sustaining.

MANAGERS RESPONSE

The Puyallup Tribe concurs with the recommendations of the HSRG for Diru Creek.

WDFW generally supports the recommendations of the HSRG, but notes that:

- The target proportion of natural origin fish in the hatchery broodstock and in natural spawning areas is a complex topic that will require additional analyses and discussion; and
- Additional funding will be required to upgrade the facilities as recommended.

White River Spring Chinook

Muckleshoot Indian Tribe, Puyallup Tribe, Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	High	High	High
Population Viability	Critical	Critical	At Risk
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Occasional	Most Years	Each Year
Hatchery Program:			
Purpose	Conservation and Harvest		
Type	Integrated		

PROGRAM DESCRIPTION

The current White River spring chinook stock derives from fish collected in the Puyallup and White rivers from the late 1970s through the early 1980s, when the entire spring chinook run was trapped and moved into the hatchery, or raised as captive brood at Hupp Springs Hatchery in South Puget Sound. At one point, fewer than 30 fish per year remained. Captive brood was reared at the NMFS Manchester site and the South Sound Net Pens, to rapidly expand the program. This stock is the only stock in the South Puget Sound Spring Chinook GDU. It is maintained at White River Hatchery (operated by the Muckleshoot Indian Tribe), which began its program with transfers from Hupp Springs' production. This stock is also maintained through adult returns to Minter Creek Hatchery in the South Sound region. A White River spring chinook salmon recovery plan was prepared in 1996, with the long-term goal of developing a self-sustaining, wild stock that could support harvest. The current program includes the on-station release of 260,000 fingerlings and 90,000 yearlings, and the release of up to 820,000 fingerlings from acclimation ponds (250,000 from Clearwater River Pond, 490,000 from Huckleberry Creek Pond and 80,000 from Cripple Creek Pond). Releases at the acclimation ponds fluctuate based on availability of broodstock. Adult collection, incubation and rearing for the on-station releases occur at White River Hatchery (260,000 fingerlings and 90,000 yearlings). Attaining the release of 830,000 from acclimation ponds requires incubation and early rearing at various stations including Hupp Springs, Voights Creek and Minter Creek.

OPERATIONAL CONSIDERATIONS

- Hatchery fish are marked with coded wire tags prior to release. Currently, nine different tag groups are used.
- A ventral clip has been applied to the acclimation pond releases since 1999.
- These different treatments have not been well evaluated in the past, but evaluation will be possible as three year-olds return this year.
- All returning fish are captured and examined, with non-coded wire tagged fish excluded from the hatchery broodstock. These unmarked fish likely include Puyallup River fall strays, endemic fall

chinook from the White River, returns from natural spawning White River springs, and unmarked returns from the acclimation pond releases.

- Surplus fish from the Hupps Springs program are planted in the acclimation ponds. Transfer from Hupp Springs/Minter Creek Hatchery has occurred at the eyed egg, fry and fingerling stages. Transfers have ranged from zero to 300,000 individuals during the last four years (1998–01).
- Some eggs from the White River Hatchery have been shipped for rearing to Minter Creek and then Voights Creek.
- Early lots go to the acclimation ponds, which could result in amplification or differential mortality of a non-representative sample of the run.
- There has been a 20–25% loss of broodstock during holding in recent years.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

This program is consistent with short-term harvest goals, but may not be consistent with providing regular harvest in the long-term because lack of local adaptation may impede or delay recovery to a harvestable level. The program has clearly provided demographic and conservation benefits, and has been critical to maintaining the White River gene pool. Until 2002, gene flow between the Hupp Springs program and the White River Hatchery has been in one direction only—from Hupp Springs to the White River. A five percent contribution of White River Hatchery males was made to Hupp Springs production in 2002. This program still presents a divergence risk between the two hatchery stocks and provides no opportunity for local adaptation for the Hupp Springs stock. Additionally, natural-origin recruits are excluded from the White River Hatchery, to prevent inclusion of non-White River genes. This strategy, intended to prevent one risk, will prolong the process of local adaptation and increases the risks from domestication.

B. Likelihood of attaining goals?

The program has achieved the goal of conserving the gene pool. The probability of developing a self-sustaining, integrated, harvestable run will depend on local adaptation and the recovery of the habitat.

C. Consistent with goals for other stocks?

The composition of the fall chinook run returning to the White River is poorly understood. These fish could represent a unique gene pool endemic to the White River. Their status and conservation needs should be addressed. There is a potential predation risk on pinks.

RECOMMENDATIONS

- Incorporate natural-origin recruits into the broodstock, taking care to ensure that these are of White River spring chinook origin. Use DNA markers and external marks to positively identify natural-origin, White River spring chinook. Develop a plan to accomplish this and begin taking actions in the short-term. Introduce an average of 10–20% natural spawning broodstock, though no more than 10% of the natural run in a given brood year.
- Stock the acclimation ponds with a representative sample of the run, to maintain within-population diversity.
- Discontinue Hupp Springs releases into the White River, to allow the White River population to locally adapt. The White River spring chinook program should be maintained exclusively at in-basin facilities. This recommendation should not be construed as implying that recovery goals for this stock have been fully achieved. Continued hatchery supplementation and habitat improvement are still essential for long-term recovery.

- Finalize and report ongoing genetic research on White River spring and fall chinook stocks, to distinguish between them.
- Evaluate the productivity of natural-origin versus hatchery-origin White River chinook, in order to determine the appropriate long-term role of the hatchery program.

COMMENTS

- The gene banking and conservation role of the Hupp Springs program has been successful in dealing with demographic risks to this stock. The assumption underlying the HSRG's recommendation to halt Hupp Springs releases is that the benefits of allowing the population in the White River to drive the local adaptation of the stock outweigh current demographic risks to the population.
- The current program is not consistent with developing a locally adapted, self-sustaining run because of its reliance on out-of-region transfers. [61]
- One option available to the managers would be to transport all or some portion of adults returning from prior Hupp Springs releases in the next few years to upriver spawning locations in the White River. This assumes that the managers are confident that there is no disease risk from this transport.

MANAGERS RESPONSE

The Puyallup Tribe is an active member of the South Sound Spring Chinook Technical Committee and concurs with the comments on this program provided by that committee (*see Appendix C?*).

WDFW agrees that the gene banking and conservation role of the Hupp Springs program has been successful, but believes that additional discussions with the affected tribes are necessary prior to eliminating releases into the White River.

[61] *See HSRG Area-Wide Recommendation on out-of-region transfers.*

Puyallup River Coho

Puyallup Tribe and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability	Critical	Critical	At Risk
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

This program began in 1917 with native Voights Creek adults. The program is maintained by returns to the hatchery, but represents a composite of local and Puget Sound stocks. It is expected that native-origin stocks predominate. Voights Creek coho are considered unique in the Puget Sound hatchery system in that they are a fairly early returning/spawning stock and in every third year, returns are slightly earlier than the other two years. 980,000 yearlings are released into the Puyallup drainage (780,000 on-station, 200,000 at Rushingwater Creek acclimation pond). Since the mid 1990s, up to 4,000 surplus hatchery adult coho have been given to the Puyallup Tribe to reintroduce above Electron Diversion Dam in the upper Puyallup watershed. Adult collection, incubation, early rearing for acclimation ponds and rearing for on-station release occur at Voights Creek Hatchery.

OPERATIONAL CONSIDERATIONS

- The hatchery stock has an extensive tagging history, as an indicator stock for South Sound coho, and is mass marked with an adipose fin clip.
- There has been a significant history of off-station coho releases throughout the basin. Releases were intensive for nearly 20 years, primarily using Voights Creek stock.
- Because hatchery releases were not identifiable, the composition of the hatchery and naturally spawning stock has been unknown until 2000–01 returns.
- Contribution of hatchery origin returns to natural spawning in index reaches for 2000 and 2001 were 25% and 12%, respectively.
- Contribution of natural origin recruits to hatchery returns for 2000 and 2001 were 0.9% and 2.1%, respectively.
- Hatchery escapement has exceeded 30,000 fish in seven of the last ten years, well in excess of spawning needs.
- Juvenile passage issues constrain the effort to reintroduce coho above the Electron Dam.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
This program provides annual harvest consistent with the goal described and apparent demographic benefits, but the current conservation benefit of the program is questionable because of uncertainties about the composition of the hatchery broodstock and the effect of hatchery straying on the naturally spawning component of the population.

B. Likelihood of attaining goals?
Both the historical and current contribution of natural origin fish to the hatchery broodstock is unknown, although the two most recent years indicate that there is little contribution from natural origin coho to the hatchery population. Since there has been no planned infusion of natural origin recruits into the hatchery broodstock, there is a risk that the hatchery component of this population has significantly diverged from the natural component. There is also a risk that, because of extensive off-station releases and strays from the hatchery, the natural spawning component has been swamped by hatchery releases and is not currently adapted to the natural environment. This creates a risk of loss of viability from domestication to the naturally spawning component. Hatchery releases also pose potential competition and predation risks to naturally produced coho in the basin.

C. Consistent with goals for other stocks?
There is a potential risk of predation to pink, chum and spring and fall chinook stocks.

RECOMMENDATIONS

- Continue adult releases for reintroduction above Electron Dam, to minimize domestication risks. Since hatchery coho returns routinely exceed escapement needs, there does not appear to be a need to provide additional consideration for this program in harvest planning. The HSRG recognizes that there is an existing legal agreement regarding the release of 200,000 smolts for use by the Puyallup Tribe. The HSRG recommends that this program be converted into an equivalent adult supplementation program.
- Improve juvenile downstream passage at Electron Dam.
- Develop a long-term plan to naturalize the coho population, both in the hatchery and on the spawning grounds above and below the Electron Dam.
- Manage this program to allow natural origin fish to drive adaptation, to the extent possible in these highly-urbanized watersheds. In order to do this, the goal should be for natural fish to constitute an average of at least two-thirds of the naturally spawning population.
- Ensure gene flow from the natural population to the hatchery population, by introducing natural-origin recruits.
- Implement rearing and release protocols resulting in smolts that migrate rapidly during the normal outmigration period
- Discontinue the pooling of gametes and adopt spawning protocols that maximize effective population size of hatchery component (see HSRG Area-Wide Recommendations).
- Consider semi-natural rearing to increase survival and perhaps reduce domestication.
- Address the need for pollution abatement ponds, and adult holding and collection facilities.
- Consider resizing the program to reduce surplus returns to the hatchery.
- Switch the index stock to Minter Creek, because Puyallup coho have life history characteristics that do not represent other coho stocks in Central and South Puget Sound.

- If stocks cannot be adequately integrated, consider operating this program as a segregated harvest program.

COMMENTS

- A need exists to address two uncertainties: 1) whether natural reproduction is driven primarily by natural- or hatchery-origin adults; and 2) whether natural reproduction is self-sustaining.

MANAGERS RESPONSE

WDFW generally supports the recommendations of the HSRG but notes that:

- The target proportion of natural origin fish in the hatchery broodstock and in natural spawning areas is a complex topic that will require additional analyses and discussion;
- Additional funding will be required to upgrade the facilities as recommended; and
- Maintenance of the Puyallup stock is valuable as a measure of fishery harvest rates, regardless of its representation of natural production.

The Puyallup Tribe agrees with the recommendations of the HSRG. However, since the program has just recently been reduced by 400,000 smolts per year, the Tribe would like to continue monitoring the program with WDFW to determine its appropriateness in meeting harvest and conservation goals.

Diru Creek Hatchery Chum

Puyallup Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[62]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Diru Creek Hatchery chum program began in 1977 with Finch Creek chum from Minter Creek Hatchery in the South Sound region. In 1991, the Finch Creek stock was replaced with Chambers Creek winter run chum. By 1993, the program became self-sustaining and is currently maintained by Diru Creek adult returns. This is one of two stocks in the South Puget Sound winter chum salmon GDU. Approximately two million fry (1.7 million at 454 fish per pound in April; 300,000 at 1,100 fish per pound in March) are released on-station. 50,000 eyed eggs are released into Puget Creek. Adult collection, spawning and incubation occur at Diru Creek.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
There is a potential straying risk to Puyallup chum. Individuals are not marked and cannot be distinguished from wild spawners. It is unknown how many wild chum enter the hatchery broodstock and how many Diru Creek Hatchery chum are spawning in the Puyallup River.

B. Likelihood of attaining goals?
The likelihood of attaining goals is unknown, due to lack of monitoring and evaluation.

C. Consistent with goals for other stocks?
There is a potential competition risk to pink and chum.

[62] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

RECOMMENDATIONS

- Differentially mark fed and unfed fry releases to monitor and evaluate the program's contribution to harvest and straying.
- Consider converting to an integrated program with local broodstock, to reduce straying risk.
- Develop a pollution abatement facility at this hatchery.
- Institute strict disinfection procedures where possible.

COMMENTS

- It is especially important to periodically monitor segregated harvest programs, in order to evaluate straying, as well as to evaluate whether natural spawners from the Puyallup River are being incorporated into the broodstock.
- Otolith marking should work for these fish if they are too small to adipose fin clip.

MANAGERS RESPONSE

The Puyallup Tribe concurs with the recommendations of the HSRG for Diru Creek.

Puyallup River Hatchery Winter Steelhead

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[63]	Low	Low	Medium
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

This program released transplants from Puyallup Hatchery (Chambers Creek stock) into the mainstem Puyallup and Carbon rivers from the 1950s until the 1990s. The Puyallup Tribe maintained a separate winter steelhead program at Diru Creek until the late 1990s, using Chambers Creek origin stock. That program has since been eliminated. Beginning in the mid 1990s, most steelhead were acclimated and released from the Voights Creek Hatchery, to facilitate broodstock recovery and reduce adult straying. Currently, volitionally returning adults maintain this program, because the in-stream weir has been inoperative since 1996. When egg take goals cannot be met with locally adapted fish, transplants are used from Bogachiel and Tokul Creek hatcheries (both Chambers Creek derivatives). 180,000 yearlings are released on-station at Voights Creek. Adult collection, spawning, incubation and rearing occur on-station. Occasionally, returns provide eggs in excess of program need. These may be reared and released as yearlings at Puyallup Trout Hatchery.

OPERATIONAL CONSIDERATIONS

- All releases are adipose fin clipped.
- Smolts are released at seven to nine per pound, around May 1.
- Single pair matings are used.
- Surface water from Voights Creek is used for rearing.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is providing a valuable harvest opportunity. Interbreeding of the hatchery stock with the naturally spawning stock is reduced by the differences in spawn time.

[63] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

B. Likelihood of attaining goals?
There is a strong likelihood that program goals will continue to be met, although recent trends in adult returns are a concern and probably related to poor ocean conditions.

C. Consistent with goals for other stocks?
There is the potential for genetic interaction with naturally spawning winter steelhead, but this is likely to be reduced for the reason stated in A, above.

RECOMMENDATIONS

- Implement Area-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- The HSRG encourages the use of locally-adapted stock (of Chambers Creek origin) for those streams. Decrease reliance on other facilities (such as Tokul Creek or Bogachiel hatcheries) to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between May 1 and May 15, at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component of both wild steelhead management zones and hatchery harvest streams.
- Investigate the reasons for the recent decline in adult winter steelhead returns, formulate a working hypothesis for the decline, and take appropriate actions.
- Take extra preventative measures, since this is a relatively new program and the hatchery has a history of costiasis, furunculosis, “ich” and cold water disease. Fish health staff should be consulted as soon as a problem is suspected, so early diagnosis and treatment can be implemented.
- Disinfect equipment used in rearing ponds between uses, to reduce the risk of pond-to-pond transfers of infections.

COMMENTS

- Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A "white paper" on this topic could increase our understanding of HSRG concerns and recommended remedies.
- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.

WDFW supports the HSRG recommendation for improved monitoring, but notes that additional funding will be required.

White River Hatchery Winter Steelhead

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[64]	Low	Low	Medium
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

20,000 yearlings from Puyallup Hatchery are outplanted into the White River at river mile 23. Adult collection takes place at Puyallup and Voights Creek hatcheries. Eggs are eyed at Voights Creek. Hatching and rearing occurs at Puyallup. Eyed eggs may be transferred in from Tokul Creek or Bogachiel hatcheries, to make up an egg take shortfall.

OPERATIONAL CONSIDERATIONS

- This is not an independent broodstock.
- All releases are adipose fin clipped.
- Smolts are released at seven to nine per pound, around May 1.
- Single pair matings are used.
- Early spawn timing of the hatchery stock reduces genetic interaction with naturally spawning fish.
- Surface water from Clarks Creek is used for rearing.
- Adults from releases are partially trapped at Buckley Trap and recycled to the White River.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is being operated in a manner consistent with its short- and long-term goals. It is providing for valuable harvest opportunity. Interbreeding of the hatchery stock with the naturally spawning stock is reduced by the differences in spawn time.

B. Likelihood of attaining goals?
There is a strong likelihood that program goals will continue to be met, although recent trends in adult returns are a concern and probably related to poor ocean conditions.

[64] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

C. Consistent with goals for other stocks?
There is the potential for genetic interaction with naturally spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above.

RECOMMENDATIONS

- Discontinue releases into the White River, as part of an Area-Wide Recommendation regarding a regional system of "wild steelhead management zones." In the interim, return adults from Buckley Trap to Voights Creek, for use as locally adapted broodstock.

COMMENTS

- Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.
- Releases previously programmed for White River could be switched to Puyallup or Voights Creek hatcheries.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A "white paper" on this topic could increase our understanding of HSRG concerns and recommended remedies.
- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.

WDFW supports the HSRG recommendation for improved monitoring, but notes that additional funding will be required.

EAST KITSAP

Overview

HABITAT[65]

The streams draining into Puget Sound from the east half of the Kitsap Peninsula are numerous, but rather small in comparison to those of the west half. They represent typical, lowland type streams with generally moderate gradients. Considerable deciduous growth, interspersed with stands of conifers, farmland, and urban/suburban development is common on all streams. Many of the streams originate from lakes, ground water run-off, or swamp-like headwater wetlands, which in several instances drain to both Puget Sound and Hood Canal tributaries. None of the streams are supported by snow run-off, as the maximum elevation is less than 500 meters. Stream profile characteristics are, for the most part, pool-riffle in nature with water quality and aquatic insect production highly conducive to anadromous fish production.

The numerous streams in East Kitsap primarily support chum, coho, steelhead and cutthroat trout. In addition, chinook use has been identified in some of the larger streams. Sockeye are sporadically observed in several streams, but no established populations have been observed. Adult and juvenile salmonid distribution is limited by natural and human-caused migration barriers, but may also be significantly influenced by decreased numbers of returning spawning adults (the extent of stream area used may decrease as adult or juvenile fish abundance declines), or by impaired habitat conditions that do not provide suitable spawning or rearing conditions. Most current distribution knowledge is based on contemporary stock assessment work (since 1965-1970), and likely represents a more confined distribution than occurred historically, when habitat and fish populations were healthier.

The climate is characterized by mild, wet winters, and warm, dry summers. The average summer temperature range is 70–80 degrees F during the day and 50–60 degrees F at night. The average winter temperature is 40–50 degrees F in the day and 30–40 degrees F at night. Precipitation patterns are characterized by frequent rainfalls of low intensity. Precipitation varies from 39” at Bremerton to more than 50” near Alexander Lake/Green Mountain.

Sinclair Inlet

The Sinclair Inlet watershed drains an area of 27,492 acres, including the creeks that flow into Sinclair Inlet (primarily along the southern shore) and the Beaver Creek watershed to the east. The watershed includes 57 miles of saltwater frontage, approximately 46 lakes with 9.7 miles of shoreline, and greater than 62 miles of streams. The watershed is characterized by many small streams that drain relatively small areas. Gorst and Blackjack creeks are the main dischargers of freshwater into the Inlet. Forest land covers 7,626 acres or about 28 percent of the watershed (20% in public ownership, 68% in private woodlots, 12% in commercial forest land). In 1990, greater than 95% of the forest land were stands over ten years of age. Rural/agricultural areas cover 10,627 acres, or about 37% of the watershed (35% covered with grass/shrubs, 64% covered with trees). Bremerton and Port Orchard are the major urban areas with additional retail centers in Gorst, Manchester and Annapolis. Kitsap

[65] *East Kitsap Salmon and Steelhead Habitat Limiting Factors Report, Don Haring, Washington Conservation Commission, November 2000.*

County designates approximately 6,658 acres (24%) of this watershed as urban. The remainder of the watershed is characterized by large parcels of pasture, forest, single-family homes, small farms, and low-intensity commercial uses.

Dyes Inlet

The Dyes Inlet sub-watershed drains an area of 30,289 acres, including the creeks that flow into Dyes Inlet and Port Washington Narrows. Approximately 40% of the watershed is within the urban area (12,231 acres) designated by Kitsap County. Bremerton and Silverdale are the major urban areas, with smaller retail centers at Chico, Tracyton and Kitsap Lake. The Jackson Park Navel Reservation, Camp Wesley Harris, and parts of the Bangor Naval Reservation are located within the watershed. The remainder of the watershed is characterized by large parcels of land used for pasture, forest, wetlands, single-family homes, small farms, and low-intensity commercial uses. Dyes Inlet is characterized by many small streams that drain relatively small areas. Clear, Barker, and Chico creeks are the main dischargers of freshwater into Dyes Inlet. Dyes Inlet contains a diverse array of land uses. Land use in the watershed was estimated to be 25% forested, 29% rural/agricultural, 40% urban, and 6% other (lakes, wetlands, military, parks, etc.). There has been extensive conversion of rural/agricultural/forest land to urban (residential and commercial) area since 1989, particularly in the Clear Creek and Barker Creek watersheds.

Port Orchard

The Port Orchard sub-watershed lies between the Sinclair Inlet and Dyes Inlet sub-watersheds (to the south and west) and the Liberty Bay/Miller Bay sub-watershed to the north. It includes those streams that flow from the west to Port Orchard, from the Kitsap Peninsula, and those that flow from the west side of Bainbridge Island on the east side of Port Orchard.

Liberty Bay/Miller Bay

The Liberty Bay/Miller Bay watershed drains an area of 27,629 acres. Approximately 48% (13,224 acres) of the watershed was identified as residential land use in 1994, with parcels varying from less than one acre to 10 acres, with 52% of the platted residential area developed at that time. Poulsbo and the marine waterfront have the highest concentrations of residential use. Land use was estimated to be: 21% (5,654 acres) commercial forest land, nine percent (2,587 acres) agricultural land (mostly small non-commercial farms), one percent (325 acres) commercial/industrial land, two percent (466 acres) military land, and two percent (640 acres) miscellaneous land use. An additional 17% (4,733 acres) was identified as open land that is likely being held for recreational purposes or as future real estate investments. This watershed experienced rapid development from 1980–90, with an increase in housing units and population of 29%. This rapid rate of development has continued through the 1990s. Many homes are located near the shore zone of the watershed, increasing possible septic effluent loading and other non-point pollutants to marine waters.

Port Madison to Foulweather Bluff

This area extends from Miller Bay, at the northwest corner of Port Madison, north to Foulweather Bluff.

Bainbridge Island

Bainbridge Island lies on the eastern side of East Kitsap, and is approximately 3.5 miles wide and 10.5 miles long, including approximately 17,607 acres. It is one of the largest islands in Puget Sound. Bainbridge Island experienced rapid growth from 1980–90, with the population growing by 3,532 people (28.7%) to approximately 15,846. The population is projected to grow to nearly 22,000 by the

year 2010. Residential development is concentrated in and around population centers and along the marine shoreline. In recent years, there has been a marked increase in the conversion of tree-covered and agricultural land to residential development. Urban development in the Winslow area has also increased. The Island has about 50 miles of shoreline. The shoreline is irregular and forms bays, harbors, coves, and lagoons. Major sand spits form Point Monroe, Wing Point, and Battle Point. The shoreline topography varies form relatively flat or gently sloping to steep with nearly vertical bluffs. Much of the land near the shore has steep slopes with a narrow, flat area next to the shore.

STOCK STATUS[66]

Stocks	Hatchery Program?	Biological Significance (L=Low, M =Intermediate, H =High)			Population Viability (L=Critical, M = At Risk, H = Healthy)			Habitat (L = Inadequate, M = Limiting, H = Healthy)			Harvest Opportunity (0 = None, L = Occasional, M = Most years, H = Each year)		
		Now	Goals		Now	Goals		Now	Goals		Now	Goals	
			Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term
Grovers Creek Hatchery Fall Chinook	Y	L	L	L	H	H	H	L	L	L	H	H	H
Agate Pass Sea Pen Coho	Y	L	L	L	H	H	H	H	H	M	H	H	H
East Kitsap Coho	Y	L/M	L/M	L/M	M	M	M	M	L/M	L	H	H	H
East Kitsap Fall Chum	Y	M	M	M	M	M	M	M/H	M/H	M/H	H	H	H
Blackjack Early Chum	N	H	H	H	M	M	H	M	M	L	H	L	L
Donkey Creek Chum	Y	L	L	L	M	M	H	L	L	M	H	H	H
East Kitsap Winter Steelhead	N	M	M	M	L	L	L	M	L/M	L	0	0	0
East Kitsap Sea-Run Cutthroat	N	M	M	M	M	M	M	M	M	M	H	H	H

Biological significance *is determined by considering a number of specific factors relating to stock origin, biological attributes and population subdivisions, with the stock defined as being of either* low, intermediate *or* high *significance.*

Population viability *is determined by considering a number of specific factors such as age class structure, spawner escapement and proportion of hatchery-origin fish in natural spawning, with the stock's viability defined as being either* critical, at risk *or* healthy. *This rating refers to the stock's ability to sustain itself in the natural environment (except in the case of a segregated harvest program, in which case the ratings are* low, medium *and* high *and refer to the stock's ability to sustain itself in the culture environment).*

The stock's spawning, freshwater, migration and estuarine ***habitat*** *is rated as either* inadequate *(target stock is unproductive and the population will go extinct, even without terminal harvest),* limiting *(target stock is productive enough for the population to sustain itself at a low level terminal harvest) or* healthy *(productivity of the stock is high and the population is capable of growth and supporting significant terminal harvest).*

Harvest opportunity *is rated according to whether the goal is to provide* no *directed harvest opportunity,* occasional *opportunity, opportunity* most years, *or opportunity* each year.

HATCHERIES

Grovers Creek Hatchery[67]

Grovers Creek Hatchery is located on Grovers Creek, which empties into Miller Bay on the northern Kitsap peninsula. The hatchery is owned and funded by the Suquamish Tribe, in trust, even though it is off the reservation. Grovers Creek Hatchery rears Grovers Creek fall chinook.

[66] *This table contains ratings for all the salmonid stocks in the sub-region, as provided by the managers. For a more detailed definition of these ratings, see HSRG Scientific Framework and Hatchery Review Program, Benefit/Risk Tool chapter.*

[67] *Provided by the Suquamish Tribal Fisheries Department, August 2002.*

Gorst Creek Rearing Ponds[68]

Gorst Creek Ponds are located at river mile 0.7 of Gorst Creek, which empties into the marine waters of Sinclair Inlet. The program was initiated in 1981 and is a cooperative effort between the Suquamish Tribe and WDFW. The facility uses 20 cubic feet per second of surface water through two 100,000 cubic foot earth ponds and two 75,000 cubic foot concrete raceways to raise 2.1 million fingerling and 100,000 yearling chinook annually. The program was founded with Grovers Creek broodstock, of Green River origin.

Agate Pass Sea Pens[69]

The Agate Pass Sea Pens are located in Agate Pass, between Bainbridge Island and northern Kitsap County. The program was initiated in 1981 and is a cooperative effort between the Suquamish Tribe and WDFW. The pens rear 600,000 coho smolts (currently from Minter Creek Hatchery, due to geographic proximity). The facility was upgraded to a single spar-buoy pen (70,500 cubic feet) in 1998. Maximum density was reduced from one pound to one-quarter pound per cubic foot.

Cowling Creek Hatchery[70]

Cowling Creek Hatchery is located on both the north and south branches of Cowling Creek, which drains into Miller Bay. The hatchery is owned and operated by the Suquamish Tribe. The adult recapture and spawning facility is located immediately downstream from the hatchery. The hatchery program was founded with local broodstock from Chico Creek from 1977–81. Cowling Creek chum are used to supplement East Kitsap chum populations.

Donkey Creek RSI Site[71]

The Donkey Creek remote site incubator (RSI) site is located less than one quarter-mile from the tidewater of Gig Harbor on City of Gig Harbor land. The facility is operated by the Gig Harbor Fisherman's Club and financed through the Washington State Aquatic Lands Enhancement Account. The facility consists of approximately 15 RSIs, a small intake dam on a culvert, and a gravity feed pipe line. The Donkey Creek RSI rears Johns Creek chum via Elson Creek and more recently Minter Creek hatchery returns (see South Sound Regional Review, Minter Creek Hatchery Chum). This is a late-timed chum stock native to Johns Creek, near Shelton, but established now at Minter Creek.

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[68] *Ibid.*

[69] *Ibid.*

[70] *Ibid.*

[71] *Provided by Darrell Mills and Chuck Baranski, WDFW, August 2002.*

Grovers Creek Hatchery Fall Chinook

Suquamish Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[72]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

This program was founded in 1978 with Finch Creek broodstock. Green River and Deschutes broodstock were used in 1979–81. These stocks are all of Green River origin. Since 1981, this program has been maintained by adult returns to Grovers Creek Hatchery. These chinook are one of many stocks that belong to the South Puget Sound, Hood Canal, and Snohomish Summer and Fall GDUs. 2.75 million fingerling smolts (two million on-station at Gorst Creek Rearing Ponds, 500,000 on-station at Grovers, 200,000 on-station at Dogfish Creek Rearing Ponds, 50,000 on-station at Clear Creek Rearing Ponds) and 150,000 yearlings (on-station at Gorst Creek) are released into the drainage. Adult collection for all programs occurs at Grovers. Spawning, incubation and early rearing for Grovers Creek, Dogfish and Clear Creek, and one million of the Gorst Creek program fish takes place at Grovers Creek. Incubation for the remaining one million of the Gorst Creek program fish takes place at Minter Creek Hatchery in the South Sound region. This is a tagged indicator stock under the Pacific Salmon Treaty, as well as a double index tag group for selective fishery evaluation.

OPERATIONAL CONSIDERATIONS

- Fall chinook from Minter Creek would be used if there was a shortfall.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is generally consistent with the goals for the stock.

B. Likelihood of attaining goals?
The program has had consistently good survival and harvest goals are met. There is some potential risk of disease, due to transfer to and from Minter Creek.

[72] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

C. Consistent with goals for other stocks?
There are potential ecological risks, due to competition with other salmonids in the marine environment. There are potential nutrient benefits in recipient streams (e.g. Gorst Creek).

RECOMMENDATIONS

- Develop on-site incubation capability to eliminate the need for transfers. In the short term, Minter Creek-bound eggs should be eyed at a Suquamish Tribal facility, to reduce disease risk.
- Continue the exemplary efforts to evaluate ecological interactions in the near shore marine areas, and adapt the program consistent with the findings.
- Review whether, under current conditions, a smaller program would still achieve program goals.
- Discontinue "back filling" with Minter Creek stock.

COMMENTS

- The Gorst Creek habitat restoration project offers an exceptional opportunity for public education and involvement.

MANAGERS RESPONSE

The Suquamish Tribe agrees with the recommendations of the HSRG and notes the following:

- The Tribe is hoping to continue the instream natural origin recruit/hatchery origin recruit and outmigrant trap, natural rearing studies, and nearshore beach seining for several years.
- The natural spawning that does occur has been observed to clean up gravel for the benefit of later arriving coho and chum, and provide significant marine nutrients into the stream/riparian zone.
- Although the project is located on City of Bremerton park land, the majority of the park use is by County residents, local schools and sports clubs.
- Even within the complexities of recovery planning for listed Puget Sound chinook, this chinook program continues to provide significant harvest opportunities for both treaty and non-treaty fishers. The Tribal partnership with WDFW and local sports clubs has been crucial to the success of this program. The tagged Grovers releases provide a valuable indicator utilized within the management of chinook stocks coast-wide.

Agate Pass Sea Pen Coho

Suquamish Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[73]	High	High	High
Habitat	Healthy	Healthy	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

This program began in 1981 as a cooperative effort with WDFW. Fish transfers from Minter Creek Hatchery (out-of-region) maintain this program. The Minter Creek coho stock derived historically from Minter Creek, and the Green and Skagit rivers (these introductions halted around 1980). 350,000 yearlings are released into Puget Sound from Agate Pass Sea Pens. Adult collection, spawning, incubation and early rearing take place at Minter. Intermediate rearing prior to salt water transfer takes place at Coulter Creek Hatchery (also out-of-region).

OPERATIONAL CONSIDERATIONS

- These fish are adipose fin clipped and a portion is coded wire tagged as an indicator stock under the Pacific Salmon Treaty.
- Agate Pass Sea Pen production peaked at 650,000 coho in 1996, and was reduced to 350,000 in 2000, due to Tribal funding shortfalls.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is consistent with the goals for the stock.

B. Likelihood of attaining goals?
Poor survival of yearlings prior to release limits harvest benefits.

C. Consistent with goals for other stocks?
Continuous introductions of out-of-region stock preclude local adaptation and risk introgression with any remaining East Kitsap native stock (especially in streams in the southern portion of East Kitsap).

[73] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

RECOMMENDATIONS

- Transfer yearlings to sea pens in March, rather than January, to assure a more advanced stage of physiological development.
- Review whether harvest goals could be met with a smaller net pen program. This would also reduce the risks associated with straying (see comments for East Kitsap coho program).

COMMENTS

- This is a situation in which the out-of-region stock (Minter Creek) may be more appropriate than the in-region option (Green River), in that Minter Creek fish are apt to be better adapted to East Kitsap's small streams.
- See comments for East Kitsap coho.

MANAGERS RESPONSE

The Suquamish Tribe agrees with the recommendations of the HSRG and notes the following:

- The Tribe has already reduced Agate Pass Sea Pen production from 650,000 to 350,000.
- In addition to the stream morphology similarities, Minter stock coho fry were planted extensively in all the larger East Kitsap streams for 20 years, ending in 1999.
- The Agate Pass Sea Pen program has historically provided robust harvest opportunities for both treaty and non-treaty fishers. The proximity to the Port Madison Indian Reservation continues to be a valuable element to the Tribe

East Kitsap Coho

Suquamish Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low/Medium	Low/Medium	Low/Medium
Population Viability	At Risk	At Risk	At Risk
Habitat	Limiting	Inadequate/Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Conservation and Education		
Type	Integrated		

PROGRAM DESCRIPTION

WDFW provides 15,000 eyed eggs from Minter Creek Hatchery in the South Sound region to Port Orchard Rotary, and 50,000 to Ollala Elementary School. The Suquamish Tribe receives 50,000 eyed eggs from Minter Creek, incubates and rears them at Grovers Creek Hatchery to 200 fish per pound, mass marks and transfers 5,000 to Dove Pond (operated by Dogfish Trout Unlimited), 10,000 to Ross Pond on Steele Creek, 2,500 to Indianola Creek, 2,500 to Kitsap Creek, 10,000 to Thompson Creek, 5,000 to Cleaver Pond (no outlet), 5,000 to Reservation Pond (no outlet), 2,000 to North Kitsap High School, 2,000 to South Kitsap High School, and 2,000 to Illahee Creek.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program imports out-of-region eggs, and is therefore not strictly consistent with goals for stocks in the East Kitsap sub-region. The importance of these inconsistencies depends upon the biological significance and viability of the population in the recipient streams (see comments below), and on the contribution of the outplanted fish to natural spawning.

B. Likelihood of attaining goals?
The program is not integrated with the natural stock and does not confer any direct conservation benefit to streams with potentially viable natural production. The program provides educational benefits and indirect conservation benefits by increasing public awareness of the importance of habitat to fish.

C. Consistent with goals for other stocks?
Effects on other stocks are unknown, but probably not significant due to the size of the program and the generally poor survival of the fry released.

RECOMMENDATIONS

- Mark a sufficient number of these releases to periodically monitor and evaluate straying into natural spawning populations.
- Evaluate the cumulative effects of this program and the Agate Pass Sea Pen program on potentially viable coho populations, especially in the southern portion of the East Kitsap sub-region (see comments below).

COMMENTS

- Northern streams are smaller and less able to support coho populations than those in the southern half of the East Kitsap sub-region. It is therefore important to understand the distribution of straying effects. They may matter little in the north, but be a problem for viable southern natural populations.
- The co-managers might, for example, consider the feasibility of managing the southern populations for natural production (with or without supplementation, using local broodstock), while providing harvest opportunities in the north through a (perhaps smaller) segregated Agate Pass Sea Pen program.
- With a better understanding of the genetic composition in southern streams, and with information about straying from the sea pen program in the north, it might be possible to manage for multiple goals.
- The HSRG supports and encourages the educational benefit this well-designed program provides.

MANAGERS RESPONSE

The Suquamish Tribe agrees with the recommendations of the HSRG, and agrees there will be utility in on-going studies examining straying and genetic complexity. The Tribe suggests that these results will need to be blended with current information correlating productivity losses with land use practices, to determine the best future management course for these coho stocks.

East Kitsap Fall Chum

Suquamish Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability	At Risk	At Risk	At Risk
Habitat	Limiting/Healthy	Limiting/Healthy	Limiting/Healthy
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

This program derives from a wild chum population collected originally from Chico Creek in Central Puget Sound. The program has been maintained from adult returns to Cowling Creek Hatchery since 1981. This stock is one of three in the Central Puget Sound Fall Chum GDU. Broodstock and egg collections occur at Cowling Creek. All eggs (two million) are incubated to the eyed stage at the hatchery, at which point 1.5 million of them are transferred to egg boxes in various drainages in East Kitsap, for release as unfed fry (300,000 at Webster's Rearing Pond on Dogfish Creek, 300,000 at Clear Creek, 300,000 at Steele Creek, 300,000 at Barker Creek, and 300,000 at Johnson Creek). Remaining eggs (500,000) are hatched and reared to 450 fish per pound at Cowling Creek and released on station.

OPERATIONAL CONSIDERATIONS

- No chum returning to Cowling Creek are passed upstream to spawn.
- Only chum returning to Cowling Creek Hatchery are used as broodstock; there has been no infusion of wild genes into the population since 1981.
- Releases are not marked in any way.
- Harvest apparently targets unfed, but not fed, fry releases.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is consistent with the short- and long-term goals for harvest. Conservation goals for reintroduction of chum into a number of streams are being met. The conservation program, however, is limited by the lack of introduction of genes from wild spawning salmon necessary to maintain an integrated program. This program provides ancillary educational benefits that have mobilized watershed stewardship groups.

B. Likelihood of attaining goals?
The program provides annual harvest, but is limited due to the life stage used. Without program changes, it is uncertain whether the conservation goal will be attained.

C. Consistent with goals for other stocks?
The program presents no obvious risks to other stocks, and is thus consistent with the goals for these stocks.

RECOMMENDATIONS

- Develop a long-term plan for a fully integrated program, both in the hatchery and on the spawning grounds. Manage this program to allow natural origin fish to drive adaptation, to the extent possible in these rapidly-urbanizing watersheds. In order to do this, the goal should be for natural fish to constitute an average of at least two-thirds of the naturally spawning population.
- Increase the harvest benefit by targeting the Cowling Creek population.
- Release fed fry into the smaller creeks. This is more likely to support harvest, and fed fry have a higher survival rate than unfed fry.
- Stop introductions in one or more of the creeks, to determine whether the populations are self-sustaining. Develop criteria for what constitutes self-sustaining populations in these creeks, so that the program can be halted when it is no longer needed. If populations prove not to be self-sustaining, review the program with respect to the approaches used, its goals or its utility.

COMMENTS

- A successful reintroduction of chum into small creeks in East Kitsap would benefit chum habitat conservation, since it may provide a motive for protecting these creeks, and because of the beneficial in-creek activity of the fish (e.g., gravel-cleaning).
- Chico Creek habitat maintenance or improvement is critical to the long-term viability of this program.

MANAGERS RESPONSE

The Suquamish Tribe generally supports the recommendations of the HSRG, but notes the following:

- The current unfed fry program has been substantially reduced.
- Targeting the Cowling Creek population is one possibility for increasing the harvest benefit. However, the original Tribal goal was to use Cowling Creek as a broodstock source to drive a fishery based on fed chum released elsewhere.
- Rapid anthropomorphic landscape changes are occurring throughout East Kitsap, combined with accelerating ground water withdrawals. The Tribe has attempted to provide a gene bank of Chico chum at Cowling Creek Hatchery. The hatchery is used for a modest enhancement/education program as well as a potential future terminal fishery targeting on artificial (fed) production, should East Kitsap natural production diminish. The Tribe recognizes the need to import Chico gametes annually into Cowling Creek Hatchery, but has lacked the funding/manpower to follow through with this plan.

Donkey Creek Chum

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability	At Risk	At Risk	Healthy
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Education		
Type	Integrated		

PROGRAM DESCRIPTION

This program was started in the late 1960s using a Hood Canal stock from Finch Creek. The program was self-sustaining until the late 1990s, when a decision was made to change to a more local stock (a late-run, South Sound stock from John's Creek, introduced to Minter Creek Hatchery via Elson Creek Hatchery, both in the South Sound region). This Minter Creek stock is one of two fall chum stocks in the South Sound GDU. One million unfed are fry released into Donkey Creek from remote site incubators. Adult collection and spawning occur at Minter, as does the eyeing of eggs.

OPERATIONAL CONSIDERATIONS

- Releases are all unmarked.
- The intention is to continue the program until returns to Donkey Creek genetically resemble a South Sound stock, rather than a Hood Canal stock.
- Donkey Creek may become part of a city park, in which case it would be ideally located for educational purposes.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program provides modest educational benefits by involving citizens in salmon recovery, but harvest benefits are unknown (see B, below).

B. Likelihood of attaining goals?
It seems likely that some harvest is being achieved because even without supplementation, the program was at one time self-sufficient. However, no effort to evaluate harvest benefit is being attempted. The present program does produce a modest educational benefit.

C. Consistent with goals for other stocks?
There is a risk of straying into a nearby creek (Crescent Creek) that supports a native fall chum

population. However, the level of straying and genetic introgression has apparently not been determined.

RECOMMENDATIONS

- Discontinue the transfer of eggs from Minter Creek for the Donkey Creek program.
- Reduce the program's size, to make the primary purpose educational, informing the public about the value to salmon of habitat improvement.
- Collect eggs from spawners returning to Donkey Creek for release as unfed fry; in addition, allow natural spawning to occur.
- Enhance the educational and cultural values provided by this program. Consult HSRG operational guidelines for ways to improve the educational benefits.[74]

COMMENTS

- A chum program based on releases of one million unfed fry is not likely to produce any significant harvest benefit.
- Downsizing the program to satisfy an educational goal should reduce the risk of straying and interbreeding with other local chum stocks.
- By keeping the program small, it should not be necessary to continue the present program to the stage where Donkey Creek returnees genetically resemble South Sound chum.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes that additional discussion with the affected tribes and cooperators are needed regarding the size of the program.

[74] *See HSRG Scientific Framework and Hatchery Review Program, chapter on Hatchery Operational Guidelines.*

GREEN RIVER

Overview

HABITAT[75]

This region is roughly contiguous with Water Resource Inventory Area (WRIA) 9, made up of the Green/Duwamish watershed and the Central Puget Sound watershed (the short independent streams that drain to Puget Sound from Elliott Bay south to the Puyallup watershed and the associated shorelines of Puget Sound). For salmon habitat conservation planning purposes, the streams on Vashon/Maury Island and its Puget Sound shorelines also are included in WRIA9. WRIA9 is bordered on the north by the Lake Washington/Cedar/ Sammamish watershed (WRIA 8) and to the south by the Puyallup/White River watershed (WRIA10).

The Green/Duwamish River is the largest freshwater component of WRIA 9. The Green/Duwamish River watershed begins in the Cascade Mountains, about 30 miles northeast of Mount Rainier, and flows for over 93 miles to Puget Sound at Elliott Bay in Seattle. Historically, the White, Green, and Cedar (via the Black) rivers flowed into the Duwamish River, and the system drained an area of over 1,600 square miles. Because of the diversion of the White River in 1911 and the Cedar River in 1916, the Green/Duwamish drainage area has been reduced to 556 square miles.

The Green/Duwamish River supported an average yearly run (fish returning to the river and those caught in the fisheries) of about 41,000 adult chinook during the period from 1968–96. The Green River has not experienced the same decline in naturally spawning chinook that has occurred in other Puget Sound rivers, but these numbers may be masked by a high rate of hatchery chinook that stray into the spawning grounds. There is very little reliable historical sources of information on anadromous and resident salmonid species abundance in the Duwamish/Green River basin. Historically, runs of chinook (spring and summer/fall stocks), pink, coho, chum, winter steelhead and cutthroat trout were present. Summer steelhead were also likely present in low numbers. There is limited evidence that sockeye spawn and rear in the basin.

Major engineered changes in the river and estuary (diversion of flows, creation of dams, and channel confinement by levee and revetment) have created conditions detrimental to fish and fish habitat. Channel complexity has been reduced, tidal marshes and flats have been eliminated, and connections with the old river side-channels have been severed. In addition, loss of connection between the river and its floodplain and other riparian areas interferes with the natural recharge functions of cold groundwater from flood infiltration and with the supply of gravel and large woody debris from riparian areas. Loss of fresh-to-saltwater transition habitat in the estuary reduces the available juvenile and adult transition and holding areas and the invertebrate food supply.

Numerous habitat types occur within this watersheds nearshore environment, including eelgrass meadows, kelp forests, flats, tidal marshes, sub-estuaries, sand spits, beaches and backshore, banks and bluffs, and marine riparian vegetation. Over the past century, the Duwamish Estuary and Elliott

[75] *Salmon And Steelhead Habitat Limiting Factors, Water Resource Inventory Area (WRIA) 9, Washington State Conservation Commission, January 2001.*

Bay have undergone substantial changes, as the area developed into an industrial seaport and urban center. Before 1906, the large, unregulated, freshwater outflow of the original Duwamish River built and maintained a large and relatively dynamic estuary in the lower Duwamish Valley. The hills now occupied by Seattle and West Seattle originally constrained the river delta. Based on early maps, the estuary was characterized by a sinuous channel and several tributaries. These stream channels would have been constantly changing, as is typical of a low-gradient river with substantial periodic sediment-laden flood flows.

Beginning as early as 1895, tide flats and salt marshes along the Duwamish River and the Seattle waterfront were filled with soil cut from hilly areas to the east and with sediments dredged to create protected harbor areas. In the early 1900s, the natural estuary was greatly modified by the construction of Harbor Island, the East and West waterways, and the Duwamish shipping channel. Creation of the waterways resulted in the replacement of 9.3 miles of meandering river with the 5.3-mile straightened channel that exists today.

Urban and industrial development over the past century has greatly modified shoreline habitats in the Duwamish Estuary and Elliott Bay. With the exception of the Magnolia Bluff area, virtually 100% of the estuary and bay shoreline has been modified with various types of armoring including levees and dikes, riprap, bulkheads and seawalls, rubble or steepened mud banks. In Elliott Bay, over-water structures are the prominent shoreline modifications, occupying over 65% of the bay shore. Behind the over-water structures, riprap and seawalls predominate, although exposed sand and mud substrates are present as well.

Land use activities have resulted in many direct and indirect impacts to salmon habitat. Loss of riparian vegetation has increased temperature and reduced leaf and insect inputs to the river, affecting the base of the salmon food chain. Increases in run-off volume have disrupted the timing and magnitude of flows, increased erosion, and carried pollutants into streams, first from agricultural, then urban sources. Pipes, culverts, ditches, and dams have resulted in blockages to fish passage and changes to the movement of gravel and large woody debris.

Water quality has been affected throughout the watershed. Wastewater and industrial discharges accentuated the effects of land use changes by reducing dissolved oxygen, altering temperatures, and releasing a variety of chronic contaminants, particularly in the lower Green River and Duwamish estuary. Erosion from agriculture, forestry, urban construction, and other activities increased the load of sediment entering the river, plugging spawning gravel and suffocating salmon eggs. Failing septic systems are also a problem in some rural and nearshore areas. Pesticides and fertilizers from farms, gardens, and yards have also altered water quality. Some common pesticides are believed to interfere with detection of olfactory cues by salmon, in addition to having direct toxicity and indirect food chain effects.

Watershed-Wide Habitat Improvement Projects

The WRIA 9 Technical Committee has developed an interim conservation and recovery strategy for the Green/Duwamish Watershed that will improve salmonid habitat. The strategy is based on the current state of knowledge of watershed conditions, including 13 habitat factors of decline and ecological principles. The strategy helps identify priority early actions for salmon conservation and recovery in the WRIA. The strategy will be revisited periodically and revised as appropriate as new information is collected and critical examination of issues yields additional insights into WRIA 9 and Puget Sound salmon conservation needs.

The WRIA 9 Strategy identifies three high-priority watershed goals for salmon conservation and recovery:

- **Protect currently functioning habitat** primarily in the Middle Green River sub-watershed and the nearshore areas of Vashon/Maury Island.
- **Ensure adequate juvenile salmon survival** in the Lower Green River, Elliott Bay/Duwamish, and nearshore sub-watersheds. Meeting this goal involves several types of actions, including protecting currently functioning habitat, restoring degraded habitat, and maintaining or restoring adequate water quality and flows.
- **Restore access for salmon** (efficient and safe passage for adults and juveniles) to and from the upper Green River sub-watershed.

The strategy identifies restoring fish access to the upper Green River sub-watershed as a high priority goal. The sub-watershed may be large enough to act as refugia for salmon, able to seed downstream areas once appropriate access and habitats have been established. In addition, the strategy recommends protection of currently functioning habitats and habitat-forming processes, restoration and enhancement of habitat along the mainstem and tributaries, and operation of Howard Hanson Dam in a manner that will reduce its adverse effects on flows, available habitat, and water quality downstream. The strategy also calls for filling data gaps concerning the Upper Green River, such as those regarding baseline habitat quantity and quality and juvenile out-migration.

STOCK STATUS[76]

Stocks	Hatchery Program?	Biological Significance (L=Low, M =Intermediate, H =High)			Population Viability (L=Critical, M = At Risk, H = Healthy)			Habitat (L = Inadequate, M = Limiting, H = Healthy)			Harvest Opportunity (0 = None, L = Occasional, M = Most years, H = Each year)		
			Goals			Goals			Goals			Goals	
		Now	Short-Term	Long-Term	Now	Short-Term	Long-Term	Now	Short-Term	Long-Term	Now	Short-Term	Long-Term
Green River Fall Chinook	Y	M	M	M	M	M	H	M	M	M	H	H	H
Green River Coho	Y	M	M	M	M	M	H	L	L	L	H	H	H
Aquarium Hatchery Coho	Y	M	M	M	M	M	M	L	L	L	H	H	H
Burien Coho	Y	L	L	L	L	L	L	L	L	L	H	H	H
Des Moines Net Pen Coho	Y	L	L	L	H	H	H	M	M	M	H	H	H
Elliot Bay Net Pen Coho	Y	M	M	M	M	M	M	M	M	M	H	H	H
Vashon Coho	Y	L	L	L	L	L	L	L	L	L	H	H	H
Aquarium Hatchery Chum	Y	L	L	L	M	M	M	L	L	L	M	M	M
Vashon Chum	Y	L	L	L	L	L	L	L	L	M	H	H	H
Green River Chum	Y	L	L	M	M	M	M	L	L	L	M	M	M
Green River Winter Steelhead	Y	M	M	M	M	M	M	M	M	M	H	H	H
Green River Hatchery Winter Steelhead	Y	L	L	L	L	M	H	M	M	M	H	H	H
Green River Hatchery Summer Steelhead	Y	L	L	L	L	M	H	M	M	M	H	H	H
Green River Sea-Run Cutthroat	N	M	M	M	M	M	M	M	M	M	H	H	H

Biological significance *is determined by considering a number of specific factors relating to stock origin, biological attributes and population subdivisions, with the stock defined as being of either* low, intermediate *or* high *significance.*

Population viability *is determined by considering a number of specific factors such as age class structure, spawner escapement and proportion of hatchery-origin fish in natural spawning, with the stock's viability defined as being either* critical, at risk *or* healthy. *This rating refers to the stock's ability to sustain itself in the natural environment (except in the case of a segregated harvest program, in which case the ratings are* low, medium *and* high *and refer to the stock's ability to sustain itself in the culture environment).*

[76] *This table contains ratings for all the salmonid stocks in the sub-region, as provided by the managers. For a more detailed definition of these ratings, see HSRG Scientific Framework and Hatchery Review Program, Benefit/Risk Tool chapter.*

The stock's spawning, freshwater, migration and estuarine ***habitat*** *is rated as either* inadequate *(target stock is unproductive and the population will go extinct, even without terminal harvest),* limiting *(target stock is productive enough for the population to sustain itself at a low level terminal harvest) or* healthy *(productivity of the stock is high and the population is capable of growth and supporting significant terminal harvest).*

Harvest opportunity *is rated according to whether the goal is to provide* no *directed harvest opportunity,* occasional *opportunity, opportunity* most years*, or opportunity* each year.

HATCHERIES

Soos Creek Hatchery[77]

Soos Creek Hatchery is located on Big Soos Creek, a tributary to the Green River, on approximately 37 acres of land owned by WDFW. The hatchery site is a half-mile upstream from the Green River at river mile 33.5. The facility is located at 13030 Auburn-Black Diamond road, three miles southeast of Auburn. The hatchery is owned and operated by WDFW, and is financed through the State General Fund and the Puget Sound Recreational Enhancement Fund. This facility was originally named the White River Hatchery when constructed in 1901, later renamed the Green River Hatchery. The hatchery was completely rebuilt in 1907, 1926 and 1948. In 1995, the hatchery was renamed the Soos Creek Hatchery.

There are two residences, one located two miles from the hatchery and the other on the hatchery grounds. There is one hatchery building, a shop, large carport, storage building, small (5' x 4') storage shed and small, covered spawning area located inside the creek. There is one pump intake for rearing, one small gravity intake for domestic water and pathogen free incubation and rearing. The hatchery building has 160 shallow troughs for incubation and 56 deep troughs for hatching. There are three ¼ acre asphalt ponds, eight 10' x 80' raceways, eight 17.5' x 95' concrete raceways, and twelve 3' x 15' fiberglass intermediate raceways. The adult holding pond is located in Soos Creek. A temporary weir across the creek is used to trap and hold adults. Soos Creek Hatchery rears Green River fall chinook, Green River coho, Chambers Creek stock winter-run steelhead, Skamania stock summer-run steelhead and Green River wild winter-run steelhead.

Icy Creek (Pautzke) Rearing Ponds[78]

The Icy Creek rearing ponds are located off the Enumclaw-Franklin Road, at river mile 48.5. The facility is owned and operated by WDFW. The program is financed through the Puget Sound Recreational Enhancement fund. The hatchery was established in 1977, originally as a spring chinook facility. The Icy Creek Pond is gravity fed from shallow springs. There are two earthen ponds, but only the approximately one-third acre lower pond is used. The upper pond is not used, as fish cannot be direct released and need to be hauled. The site is isolated and there are currently no surrounding housing developments. There are no on-site buildings. Icy Creek rears Green River fall chinook.

Palmer Ponds[79]

Palmer Ponds is approximately 12 acres and is located at river mile 56 on the Green River in King County. The property is owned by WDFW and financed through Wildlife funds. There are two buildings, a residence and carport/storage building. There are two earthen ponds, one of one acre, and one of 0.4 acres. There are four 20' round ponds. The lower earthen pond drains into a migrant smolt

[77] *Information provided by the Soos Creek Hatchery Crew, Brodie Antipa and Darrell Mills, WDFW, August 2002.*
[78] *Ibid.*
[79] *Ibid.*

and adult trap. All ponds are gravity fed with spring water. Palmer Ponds rears Chambers Creek stock winter-run steelhead and Skamania stock summer-run steelhead.

Keta Creek Hatchery[80]

Keta Creek Hatchery is located approximately eight miles southeast of Auburn, just off Green Valley Road. It is situated next to Crisp Creek, one mile upstream from the confluence of Crisp Creek and the Green River. The 28 acre hatchery site is held in federal trust for the Muckleshoot Tribe. The facility rears fall chinook, coho and chum and steelhead. Funding to culture all stocks comes from the Muckleshoot Tribe, Tacoma Public Utilities, and the Bureau of Indian Affairs. Keta Creek has one staff house, two storage/work shops, pollution abatement ponds, eight 4' x 40' concrete start tanks, four 10' x 100" x 4' rearing raceways, and an office building containing a lab and freezer. The hatchery building houses heath tray incubators, start tanks, a formalin room, and various pieces of water quality equipment.

Crisp Creek Hatchery[81]

The three acre Crisp Creek Rearing Ponds complex is adjacent to Keta Creek Hatchery. It is owned by WDFW, but operated by the Muckleshoot Tribe, in conjunction with operations at Keta Creek. Crisp Creek Ponds contain two one-quarter acre earthen ponds and five 5' x 40' x 4' rearing tanks. Funding to culture all stocks comes from the Muckleshoot Tribe, Tacoma Public Utilities, and the Bureau of Indian Affairs.

Seattle Aquarium[82]

The Seattle Aquarium is located on the waterfront in downtown Seattle, on Elliott Bay. The Aquarium is operated by the City of Seattle as a public aquarium, for the purpose of public education and entertainment. It is a popular attraction in the busy waterfront hub of Seattle. As part of its emphasis on local and eastern Pacific Rim marine fish and wildlife species, the Aquarium has focused special attention on the life cycle of Pacific salmon. The Aquarium is equipped to trap, spawn, incubate, rear and release sufficient numbers of fish for educational purposes and is able to display all life stages to the viewing public. The facility rears both coho and chum and has done so for over 20 years, in cooperation with WDFW. Small numbers of returning chum and coho are trapped and spawned at the site for educational purposes. The remaining fish for the program come from the Minter Creek and Soos Creek hatcheries. The Aquarium is equipped with vertical incubators, small starting and rearing tanks and a large sea water tank, which has a viewing window that allows viewing from beneath.

SeaTac Occupational Skills Center[83]

The SeaTac Occupational Skills Center (OCS) is located in the town of Burien, at Seahurst Beach. The OCS is a high school level, alternative education program administered through the Highline School District and is available to high school juniors and seniors from that district. Part of the OSC curriculum, Marine Technology, features a hands-on salmon, culture facility with a small scale hatchery program capable of the full hatchery cycle, from adult trapping to release. The facility specializes in rearing coho to fingerling and yearlings size, for planting into the unnamed watershed. The water supply is a small, steep, spring-fed creek that drains directly into Puget Sound. The creek is

[80] *Information provided by Dennis Moore, Muckleshoot Tribe, October 2002.*
[81] *Ibid.*
[82] *Information provided by Darrell Mills, WDFW, August 2002.*
[83] *Ibid.*

occasionally subject to storm run-off, which has caused mortality in the past. Soos Creek coho acts as a back-up source of fish for this educational program.

Des Moines Net Pen[84]

The Des Moines Net Pen is located in the town of Des Moines, south of Seattle. The net pen project is a cooperative effort between WDFW and the Northwest Salmon and Steelhead Council, Des Moines Chapter. The project has been in operation for over 20 years and is financed through the Aquatic Lands Enhancement Account. The site was originally used to rear delayed-release chinook, but that program has been dropped due to concerns about adults straying into the watersheds of the region. The site currently rears only Soos Creek coho smolts.

Elliott Bay Net Pen[85]

The Elliott Bay Net Pens are a cooperative effort between the Muckleshoot and Suquamish tribes, begun in 1994. Green River coho broodstock are spawned at the WDFW facility, incubated, reared for a short time, then transferred to the Crisp Creek Rearing Ponds operated by the Muckleshoot Tribe. Approximately 450,000 yearlings are shipped in March of each year to the two, 100,000 cubic foot ocean spar nets, located south of Terminal 88 in Elliott Bay. The coho are reared until June 15, then released into Elliott Bay.

[84] *Ibid.*

[85] *Information provided by Suquamish Tribal Fisheries Department, November 2002.*

Green River Fall Chinook

Washington Department of Fish and Wildlife and Muckleshoot Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability	At Risk	At Risk	Healthy
Habitat	Limiting	Limiting	Limiting[86]
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

The Green River fall chinook sub-yearling program began in 1901 with adults collected from the Green River. The yearling program began in 1983. Hatchery broodstock for both sub-yearling and yearling releases is randomly selected from adults trapped at Soos Creek Hatchery on the Green River. The hatchery stock has been self-sufficient for decades. The broodstock is considered to represent the native Green River stock, with little genetic influence from outside the region. Green River fall chinook belong to the South Puget Sound, Hood Canal and Snohomish Summer and Fall GDUs. 3.2 million fingerlings are released on-station at Soos Creek Hatchery. 300,000 fingerlings are transferred to Icy Creek Pond, approximately 15 miles upstream, for release as yearlings. There are no adult trapping facilities at Icy Creek. 600,000 eyed eggs are transferred to Keta Creek Hatchery for hatching, and then outplanted as fry above Howard Hanson Dam (river mile 64.5).

OPERATIONAL CONSIDERATIONS

- The proportion of natural-origin adults among fish spawned for broodstock averaged 42% per year 1990–99.
- Coded wire tag data show that the proportion of natural spawners comprised of Soos Creek Hatchery-origin adults within the mainstem Green River averaged 37.3% from 1989–99 (with a range of zero to 67%). The proportion of natural spawners comprised of Icy Creek Hatchery-origin adults averaged 18.7% (with a range of zero to 100%) during the same nine years. The overall proportion of natural spawners comprised of hatchery-origin adults has averaged 59.6% for the years 1989–2000 with "other" hatchery fish constituting 3.6% of natural spawners. These proportions should be interpreted with caution, because of small sample sizes and the restricted region of the mainstem river surveyed (eight miles between mouths of Soos and Icy creeks). In general, the proportion of natural spawners comprised of hatchery-origin adults in the Green River has exceeded 50%, approximately 50% of the time.

[86] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

- The proportion of natural spawners comprised of Soos and Icy creek hatchery-origin adults in Newaukum Creek averaged 28.8% (with a range of zero to 68%) and 17.9% (with a range of zero to 42.3%), respectively, for 11 years between 1989 and 1999.
- The annual natural escapement goal for fall chinook salmon in the Green River drainage is 5,800 adult spawners. The annual escapement goal for the Soos Creek Hatchery is 3,500 adults. Escapement to the hatchery has exceeded 9,000 adults every year since 1995, except for 2000, when escapement was approximately 6,000.
- Up to 3,500 adults are passed upstream of the adult trap for natural spawning in Soos Creek.
- Adults are spawned pairwise (one-to-one) for fingerling releases. For the Icy Creek yearling program, adults are spawned in gamete pools of three males and three females.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

This program is conferring significant harvest benefits. Harvest rates on this hatchery stock averaged 63% for brood years 1985–93 based on coded wire tag data, with approximately 65% of the harvest occurring in waters of Washington state. The program is likely to continue meeting harvest goals in a compromised habitat and appears to be providing a demographic benefit to the overall escapement and abundance of fall chinook in the Green River. This demographic benefit may be indirectly helping to maintain the biological significance of this stock in the Green River watershed. However, the large numbers or hatchery-origin adults spawning in the Green River is a significant concern, as they may be competing with natural-origin adults for spawning habitat. A decrease in habitat quality or quantity would also present a risk to meeting harvest and conservation goals.

B. Likelihood of attaining goals?

The long-term genetic consequences of the hatchery program on the fitness and productivity of the natural population in the Green River is unknown. The hatchery program may be affecting the long-term self-sustainability of the natural fall chinook stock, as may a decrease in habitat quality or quantity.

C. Consistent with goals for other stocks?

Predation risks on sub-yearling coho, chinook and chum may exist from yearling releases. There may be nutrient benefits from hatchery-origin carcasses in the Green River.

RECOMMENDATIONS

- Conduct a stomach content study of hatchery-origin yearling chinook from the Icy Creek Pond that are caught downstream in the Green River smolt trap or other sites in the lower river, to determine if these fish are preying on other salmonids. Use the results of this study to determine what, if any, changes should be made to the program.
- Modify the yearling program to allow collection of returning adults. This could be accomplished by constructing adult recapture facilities at Icy Creek and Newaukum Creek.
- Release all components of the program volitionally.
- Design and construct an adult holding and sorting pond that is not in the mainstem of Soos Creek at the Soos Creek Hatchery. This new facility should include bypass facilities for efficiently passing adult fish upstream, and a weir for diverting upstream migrating fish into the holding pond.
- Continue to evaluate semi-natural rearing methods to increase survival and reduce potential domestication.

- Manage this program to allow natural origin fish to drive adaptation, to the extent possible in this highly-urbanized watershed. In order to do this, the goal should be for natural fish to constitute an average of at least two-thirds of the naturally spawning population.
- Determine the natural spawning escapement and its composition (hatchery- and naturally-origin), and the number and composition of the resulting recruitment.
- Select broodstock for the yearling releases to represent the entire run timing. Use BKD control strategies consistent with this selection process.
- Continue to incorporate natural-origin spawners in the hatchery broodstock consistent with HSRG guidelines.

COMMENTS

- Returning adults from the yearling release (YR) are, on average, older than returning adults from the sub-yearling release (SR) based on CWT returns, 1987-1993. Age 2: YR, 1.83%; SR, 4.76%. Age 3: YR, 10.74%; SR, 30.03%. Age 4: YR, 67.43%; SR, 57.76%. Age 5: YR, 17.79%; SR, 4.12%). These data contrast with data for other fall chinook programs in Puget Sound.
- This broodstock appears to be highly integrated genetically with natural-origin adults returning to the Green River.
- Currently, approximately one-third of the hatchery broodstock is derived from natural spawners. This is consistent with a highly-integrated program. No discernable evidence of genetic divergence has been identified.
- The co-managers recognize that the current average of 60% hatchery-origin natural spawners in the Green River is a concern. This needs to be addressed by the co-managers in the context of developing long-term habitat and stock management goals.
- A monitoring and evaluation program and research are necessary to ensure continued success of the program and to evaluate the program's effects on the fitness of the natural population over time. There is uncertainty as to whether the high proportion of hatchery-origin adults among natural spawners compromises the fitness of the natural population in the Green River.

MANAGERS RESPONSE

WDFW generally supports the recommendations of the HSRG, but notes that:

- The target proportion of natural origin fish in the hatchery broodstock and in natural spawning areas is a complex topic that will require additional analyses and discussion; and
- Additional funding will be required to upgrade the facilities as recommended.
-

WDFW has taken the following actions consistent with the HSRG recommendations:

- Implemented collection and evaluation of the stomach contents of smolts captured at the Green River smolt trap;
- Will test trap and collection facilities in 2003 for adults returning to Icy and Newaukum creeks (subject to approval from NOAA Fisheries); and
- Conducted a three year study of the magnitude and composition of natural spawning escapement in the Green River.

Green River Coho

Washington Department of Fish and Wildlife, Muckleshoot Tribe, Suquamish Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability	At Risk	At Risk	Healthy
Habitat	Inadequate	Inadequate	Inadequate[87]
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

The Green River coho program began in 1901 with native adults collected from the Green River. Additional stocks were occasionally imported in the early days of the hatchery operation, but their contribution is not believed to be significant. The program has been maintained by adult returns to the hatchery for many decades. The program produces 800,000 yearlings (600,000 on-station at Soos Creek Hatchery, 200,000 on-station at Crisp Creek Hatchery) and 800,000 fry (500,000 fry outplanted above Howard Hanson dam, above river mile 64.5, from Keta Creek Hatchery, 300,000 fry outplanted into the lower river tributaries from Soos Creek) released into the Green River. Adult collection, incubation and early rearing for all releases are at Soos Creek. 400,000 yearling smolts are released from the Elliott Bay Net Pens. Adult collection, spawning, incubation and early rearing occur at Soos Creek. Intermediate rearing prior to salt-water transfer takes place at Crisp Creek.

OPERATIONAL CONSIDERATIONS

- The managers plan to collect brood from all temporal segments of the run returning to Soos Creek, but often are not able to collect late-returning broodstock.
- Fish are released from the hatchery earlier than the ideal release time because of programming constraints.
- Control of predatory birds at the hatchery is difficult without adequate netting.
- Pollution abatement at the hatchery site is not adequate.
- Fish for the Elliott Bay Net Pen release site are vaccinated at Crisp Creek before being introduced into the pens.
- Fish for the Elliott Bay Net Pen release site are not mass marked, but 10–12.5% have historically had coded wire tags.

[87] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is consistent with harvest goals, having provided substantial annual harvest over many years. The interaction—mixed parentage—of hatchery and wild-spawning coho in the Green River is consistent with mid- and long-term goals for this stock of medium biological significance. It is also consistent with conservation goals, in that the hatchery provides demographic support for coho spawning in the urbanized habitat of the Green River, although the risk of lost fitness through domestication is important.

B. Likelihood of attaining goals?
The program is likely to continue to support the integrated goals of conservation and harvest. Habitat is unlikely to improve, and the integrated stock may be increasingly domesticated.

C. Consistent with goals for other stocks?
Green River chum fry, and natural chinook and coho fry, are at risk of predation by coho smolts produced from the program. Adults returning to the Elliott Bay Net Pen site stray to, and interbreed with, other coho stocks at an unknown rate (substantial numbers of coded wire tagged adults are recovered at other hatcheries, including those inside the Ballard Locks and on the Kitsap Peninsula), potentially reducing the population fitness (the local-adaptedness) of those stocks.

RECOMMENDATIONS

- Release fish later, when they are fully smolted and outmigration will occur rapidly. There are a number of options available for adjusting the program and/or the facilities to achieve this result
- Ensure sufficient gene flow from the naturally-spawning segment of the population by incorporating known natural-origin recruits in the hatchery broodstock. If there has been no divergence, this should be at the rate of at least 10–20% per year on average.
- Mark all releases, including smolts released from net pens.
- Evaluate straying (and gene flow where possible) from different segments of the stock (on-site releases, upstream releases, lower river tributary releases, net pen releases, natural spawning).
- Do not increase the size of Elliott Bay Net Pen releases until the effects of straying have been evaluated; releases should then be sized at an appropriate level.

COMMENTS

- Mass marking will allow the managers to determine over time whether genetic divergence from the natural stock has occurred.

MANAGERS RESPONSE

WDFW generally supports the recommendations of the HSRG, but notes the following:
- The target proportion of natural origin fish in the hatchery broodstock and in natural spawning areas is a complex topic that will require additional analyses and discussion.
- Delaying the release of smolts from Soos Creek Hatchery requires balancing the risk that fish held to a later date in the creek ponds will be lost in flood events. WDFW is evaluating short- and long-term solutions, including the development of incubation and early rearing facilities at Icy Creek and Palmer Ponds.
- Additional funding will be required to evaluate the magnitude of straying.

Aquarium Hatchery Coho

Seattle Aquarium and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability[88]	Medium	Medium	Medium
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Education and Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Aquarium coho program began in the late 1970s with fingerlings from Minter Creek Hatchery in the South Sound region. More recently, it has been maintained with fish from the Green River. 12,500 fingerlings and 25,000 yearlings are released on-station into Elliott Bay. Adult collection, spawning, incubation and early rearing for fingerling releases occur on-station. Adult collection, spawning, incubation and early rearing for yearlings releases occur at Soos Creek Hatchery.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The direct release of sub-yearling coho into Elliot Bay most likely results in little survival or adult returns and is therefore inconsistent with harvest goals.

B. Likelihood of attaining goals?
The educational benefits from this program are high. Harvest benefits are unknown.

C. Consistent with goals for other stocks?
Yes.

RECOMMENDATIONS

- Focus on the educational goal of this program, rather than harvest benefits.

[88] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

COMMENTS

- The contribution of yearling releases to harvest, and their potential straying, could be evaluated.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Burien Coho

Northwest Salmon and Steelhead Council, SeaTac Occupational Skills Center, and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability	Critical	Critical	Critical
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Education and Harvest		
Type	Integrated		

PROGRAM DESCRIPTION

The Burien coho program began in 1985 with eggs of Green River origin. This program is now maintained by returns to a small hatchery operated by the SeaTac Occupational Skills Center (OSC) as part of the Marine Technology curriculum. The OCS is an alternative educational program at the high school level. Additional eyed eggs from Soos Creek Hatchery are brought in, as needed, to meet release goals. 120,000 fry are scatter planted (33,000 to Miller Creek, 54,000 to Des Moines Creek, and 33,000 to Walker Creek). 15,000 fry and 10,000 yearlings are released from the OCS facility, which is on a small, spring-fed creek. Early rearing for yearling release also occurs at Soos Creek.

OPERATIONAL CONSIDERATIONS

- This is a cooperative program with the Northwest Salmon and Steelhead Council.
- The program has changed recently from releasing fed fry to releasing unfed fry, to reduce potential competition with natural-origin juveniles.
- Approximately one-half of the fry are released upstream of anadromous fish barriers.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
Educational benefits relate primarily to the value of habitat for sustaining salmon populations.

B. Likelihood of attaining goals?
Harvest benefits are unknown.

C. Consistent with goals for other stocks?
Competition risks exist with natural-origin juveniles, because of the number of fry released.

RECOMMENDATIONS

- Determine the status of natural populations in Des Moines, Miller, and Walker creeks.

- Resize the program, adjusting the number of fry released to reflect the status of the natural populations and watershed capacities.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Des Moines Net Pen Coho

Northwest Salmon and Steelhead Council and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[89]	High	High	High
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Des Moines net pen coho program began in 1988 with fish of Green River origin. Juvenile fish from Soos Creek Hatchery currently maintain this program. 25,000 yearlings are released into Puget Sound from Des Moines marine net pens. Adult collection, spawning, incubation and initial rearing are at Soos Creek.

OPERATIONAL CONSIDERATIONS

- This is a cooperative program with the Northwest Salmon and Steelhead Council.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
Yes.

B. Likelihood of attaining goals?
Unknown.

A. Consistent with goals for other stocks?
Yes.

RECOMMENDATIONS

- Continue to mark released fish.
- Monitor and evaluate contribution to harvest and straying periodically.

[89] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes that additional funding will be required for coded-wire tagging and assessment of straying.

Vashon Coho

Vashon Sportsmen and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[90]	Low	Low	Low
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Education and Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

30,000 fry are outplanted from Soos Creek Hatchery (15,000 into Judd Creek and 15,000 into Shinglemill Creek). Adult collection, spawning, incubation and early rearing occur at Soos Creek.

OPERATIONAL CONSIDERATIONS

- This is a cooperative program with the Vashon Sportsmen's Club.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
Under the premise that the recipient streams have no native stocks and little or no natural production potential (low biological significance and viability now and in the future), this program is generally consistent with short- and long-term goals for the stock.

B. Likelihood of attaining goals?
Education goals can be met. The project contributes to greater public awareness of the importance of habitat to salmon. Harvest benefits are unknown.

C. Consistent with goals for other stocks?
No goals have been identified for other stocks in these streams. Ecological interactions with resident species are unknown.

RECOMMENDATIONS

- Periodically evaluate program benefits (contribution to harvest and natural spawning).

[90] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

COMMENTS

- The potential for future natural production in small streams like these should be reviewed periodically to determine if habitat status and viability of the naturally spawning stock warrant upgrading.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes that additional funding will be required for coded-wire tagging and assessment of straying.

Aquarium Hatchery Chum

Seattle Aquarium and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[91]	Medium	Medium	Medium
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Most Years	Most Years	Most Years
Hatchery Program:			
Purpose	Education and Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Aquarium chum program began in the 1980s with eggs from Finch Creek and fry from Minter Creek Hatchery in the South Sound region. Beginning in 1990, the stock changed to John's Creek, via Minter Creek. This program collects some eggs from adults returning to the Aquarium, but is also maintained by annual introductions from Minter Creek as needed. This stock belongs to the Central/South Puget Sound Fall GDU. 40,000 fry (400 fish per pound) and 60,000 fingerlings (100 fish per pound) are released on-station into Elliott Bay. A small number of returning adults (up to 15 pairs) are trapped and spawned at the Aquarium with incubation, rearing, and fry releases occurring on-station. Adult collection, spawning, and initial incubation to the eyed stage for the fingerling releases occur at Minter Creek.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
This program is providing educational benefits. Harvest benefits are unknown.

B. Likelihood of attaining goals?

C. Consistent with goals for other stocks?
No appreciable risks appear to be associated with this program, although potential straying of returning adults into the Duwamish and Green rivers may occur.

[91] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

RECOMMENDATIONS

- Use Green River instead of Minter Creek stock for this program. Obtain eyed eggs from the Keta Creek Hatchery.
- Consider doing all adult trapping, incubation, and pre-release rearing at one location (i.e., the Aquarium). This would increase the educational value of the program.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Vashon Chum

10 Million Salmon and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[92]	Low	Low	Low
Habitat	Inadequate	Inadequate	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Education and Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

50,000 unfed fry released into Judd Creek from remote site incubators. Adult collection, spawning and eyeing occur at Minter Creek Hatchery in the South Sound region.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
Under the premise that the recipient streams have no native stocks and little or no natural production potential (low biological significance and viability now and in the future), this program is generally consistent with short- and long-term goals for the stock.

B. Likelihood of attaining goals?
Education goals can be met. The project contributes to greater public awareness of the importance of habitat to salmon. Harvest benefits are unknown, but likely to be small.

C. Consistent with goals for other stocks?
No goals have been identified for other stocks in these streams. Ecological interactions are minimal.

RECOMMENDATIONS

- Periodically evaluate program benefits (contribution to harvest and natural spawning).

[92] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

COMMENTS

- Natural production potential for chum may become viable in the long-term, with habitat improvements.

MANAGERS RESPONSE

WDFW generally supports the intent of the HSRG recommendation, but notes that evaluating the contribution to harvest could be prohibitively expensive for a program of this size.

Green River Chum

Muckleshoot Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Medium
Population Viability	At Risk	At Risk	At Risk
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Most Years	Most Years	Most Years
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

This program began in 1975, with broodstock of Hood Canal origin (Finch Creek). The program began a transition to Central Sound-origin chum from Cowling Creek Hatchery broodstock in the early 1990s. This stock is one of three in the Central Puget Sound Fall Chum GDU. Two million fry are released on-station at Keta Creek Hatchery into Crisp Creek. Adult collection, spawning, incubation and rearing occur on-station. Harvest goals include incidental harvest by commercial fisheries and subsistence harvest by traditional users. Conservation goals include the introduction and supplementation of chum in the Duwamish and Green rivers.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is consistent with its goals. Cowling Creek is the appropriate broodstock. Some harvest benefit is being derived.

B. Likelihood of attaining goals?
Incidental harvest in the coho commercial fishery occurs each year; some subsistence harvest does occur but the number of fish harvested is not known. Attaining conservation goals would require habitat improvements and allowing for local adaptation of this stock.

C. Consistent with goals for other stocks?
Yes.

RECOMMENDATIONS

- Establish a program to mark all fry produced from the hatchery (e.g., otolith thermal marking).

- Document the harvest—both commercial and subsistence—of this stock for at least five years, differentiating between natural- and hatchery-origin fish in the harvest.
- Assess the abundance and distribution of natural spawning fish in the watershed for at least five years.
- Document the contribution to natural spawning of hatchery produced fish by estimating the proportion of marked fish in the naturally spawning segment of the stock in each of the five years.
- Incorporate an annual average of 10–20% naturally spawning fish in hatchery broodstock.
- Assess the importance of the hatchery program to the sustained harvest of the stock, and to the viability of the natural spawners in each of the five years.
- Collect and analyze tissue samples from returning hatchery adults to ensure that conversion to a Central Puget Sound stock is adequate. If the result of this genetic analysis is that the conversion is not adequate, use Cowling Creek broodstock as necessary to meet goals.

COMMENTS

- None.

MANAGERS RESPONSE

No response received at time of publication. Check Hatchery Reform Project web site for responses received after publication date: www.lltk.org/hatcheryreform.html.

Green River Winter Steelhead

Muckleshoot Tribe and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability	At Risk	At Risk	At Risk
Habitat	Limiting	Limiting	Limiting[93]
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

40,000–80,000 fingerlings are outplanted into the Green River or tributaries from Keta Creek Hatchery. Adults are collected by hook and line in-river, matured, spawned, incubated and reared at Keta Creek. If annual escapement objectives are met, fingerlings are adipose clipped and outplanted. If escapement objectives are not met, pre-smolts remain unmarked and are outplanted into areas with low natural spawning. Up to 33,000 adipose fin clipped and ventral marked yearlings are acclimated and released on-station at Crisp Creek Hatchery. Adults for the yearling component are collected by hook and line in-river, and matured and spawned at Keta Creek, then incubated and early reared at Soos Creek Hatchery.

OPERATIONAL CONSIDERATIONS

- This is a new program.
- Fingerlings may or may not be adipose fin clipped, depending upon meeting escapement objectives.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program could realize some minimal effect in regards to harvest, but quantification of results has not been possible due to it being a new program. Long-term quantification of results is also doubtful, due to small numbers and an inability to accurately assess adult returns. This program is not consistent with conservation goals as presently designed, because of the small genetic effective size of the broodstock and the potential for genetic swamping (the Ryman/Laikre effect). On the other hand, collecting more adults for broodstock could create demographic risks to the natural population.

[93] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

B. Likelihood of attaining goals?
Conservation goals cannot be attained, as described above. The likelihood of attaining harvest goals is constrained by the high mortality of the broodstock, the use of low-surviving fingerling releases, and the small size of the program.

C. Consistent with goals for other stocks?
Minimal negative interactions are to be expected, due to the small size of the program.

RECOMMENDATIONS

- Discontinue the current conservation program, since the benefits are unlikely to exceed the genetic and demographic risks it creates.
- Discontinue fingerling releases; follow HSRG steelhead release guidelines.
- Evaluate the program's contribution to harvest and continue only a harvest benefit is established and the conservation risk is addressed by selective removal of a significant proportion of returning hatchery-origin adults.
- If the program continues, follow HSRG Area-Wide Recommendations for steelhead (see other steelhead program reviews).

COMMENTS

- None.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:
- A "white paper" on this topic could increase our understanding of HSRG concerns and recommended remedies.
- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes. Modification of the program should not occur until these tasks are completed.

Green River Hatchery Winter Steelhead

Washington Department of Fish and Wildlife and Muckleshoot Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[94]	Low	Medium	High
Habitat	Limiting	Limiting	Limiting[95]
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Green River hatchery winter steelhead program began in 1969–70 with transplants from the Chambers Creek Hatchery. Currently, this program is maintained by adult returns to Palmer Ponds, with supplemental fish coming from Tokul Creek Hatchery in the Stillaguamish/Snohomish region, if needed. 200,000 yearlings are released on-station (190,000 at Palmer Ponds, 10,000 at Flaming Geyser Ponds). Adult collection occurs at Palmer Ponds and Keta Creek Hatchery. All adults are transferred to Palmer Ponds for maturation. Incubation and early rearing occurs at Soos Creek Hatchery. Eggs may be transferred in from Tokul Creek (more than 50% on average for last four years) or Bogachiel Ponds, to make up for an escapement shortfall.

OPERATIONAL CONSIDERATIONS

- Fish are released at 4.5–6.5 per pound from late April to mid-May.
- All releases are adipose fin clipped.
- Single pair matings are used.
- Eyed eggs from Tokul Creek or Bogachiel River hatcheries are used, due to shortfalls of local broodstock.
- Flaming Geyser release ponds lack adult collection capability.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is

[94] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

[95] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

providing for valuable harvest opportunity. Interbreeding of the hatchery stock with the naturally spawning stock is minimized by the differences in spawn time.

B. Likelihood of attaining goals?
There is a strong likelihood that program goals will continue to be met, although recent trends in adult returns are a concern and probably related to poor ocean conditions.

C. Consistent with goals for other stocks?
There is the potential for genetic interaction with naturally spawning winter steelhead, but this is likely to be minimized for the reason stated A, above.

RECOMMENDATIONS

- Implement Area-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- The HSRG encourages the use of locally-adapted stock (of Chambers Creek origin) for those streams. Decrease reliance on other facilities (such as Tokul Creek or Bogachiel hatcheries) to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between May 1 and May 15, at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.
- Discontinue releases at Flaming Geyser Ponds, due to lack of adult collection capabilities.
- Institute predator control methods at Palmer Ponds.
- Increase volitional release timing prior to forced release.

COMMENTS

- Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A "white paper" on this topic could increase our understanding of HSRG concerns and recommended remedies.
- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.
- WDFW requests additional clarification on the recommendations to discontinue releases at Flaming Geyser Ponds. Based on current survival and harvest rates, the potential of this program to adversely impact wild fish does not appear to be significant.

Green River Hatchery Summer Steelhead

Washington Department of Fish and Wildlife and Muckleshoot Tribe

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[96]	Low	Medium	High
Habitat	Limiting	Limiting	Limiting[97]
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Green River hatchery summer steelhead program began in 1969–70 with transplants from the Chambers Creek Hatchery (Skamania origin, Lower Columbia River Basin). More recently, the program has been maintained with transplants from Reiter Ponds in the Stillaguamish/Snohomish region of Skamania River stock summer-run steelhead. Currently, this program is maintained by returns to Soos Creek Hatchery and Palmer Ponds, with Reiter as backup if needed. 100,000 yearlings are released on-station (46,000 at Palmer, 29,000 at Soos, 20,000 at Icy Creek, 5,000 at Flaming Geyser Ponds). Adult collection occurs at Palmer, Soos and Keta Creek Hatchery. All adults are transferred to Palmer for maturation. Incubation and early rearing occurs at Soos.

OPERATIONAL CONSIDERATIONS

- Fish released at 4.5–6.5 per pound from late April to mid-May.
- All releases are adipose fin clipped.
- Single pair matings are used.
- Eyed eggs may be transferred in from Reiter Ponds to make up for escapement shortfall (ranging from zero to 100% over last few years).
- Flaming Geyser and Icy Creek ponds do not have adult collection facilities.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is

[96] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

[97] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

providing valuable harvest opportunity. Interbreeding of the hatchery stock with the naturally spawning stock is minimized by the differences in spawn time.

B. Likelihood of attaining goals?
There is a strong likelihood that program goals will continue to be met, although recent trends in adult returns are a concern and probably related to poor ocean conditions.

C. Consistent with goals for other stocks?
There is the potential for genetic interaction with naturally spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above. There is an introgression risk to winter steelhead, due to controlled river flows that may allow hatchery fish to spawn in the wild.

RECOMMENDATIONS

- Implement Area-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- Use locally-adapted stock (of Skamania origin) for those streams. Decrease reliance on other facilities (such as Reiter Ponds) to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between May 1 and May 15, at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.
- Discontinue releases at Flaming Geyser and Icy Creek ponds, due to lack of adult collection capabilities.
- Institute predator control methods at Palmer Ponds.
- Increase volitional release timing prior to forced release.

COMMENTS

- Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.

MANAGERS RESPONSE

WDFW appreciates the HSRG recommendations on Wild Steelhead Management Zones, but notes:

- A "white paper" on this topic could increase our understanding of HSRG concerns and recommended remedies.
- As a companion to the HSRG white paper, WDFW proposes to conduct a series of workshops on steelhead during 2003 to discuss recent research, performance of the hatchery programs, and management options (including integrated and segregated programs).
- Implementation of any changes in the steelhead program will require consultation with the Fish and Wildlife Commission and the affected tribes.
- WDFW requests additional clarification on the recommendations to discontinue releases at Flaming Geyser Ponds. Based on current survival and harvest rates, the potential of this program to adversely impact wild fish does not appear to be significant.
- Consistent with the HSRG recommendation, WDFW will in 2003 test trap and collection facilities for adults returning to Icy Creek (subject to approval from NOAA Fisheries).
- WDFW notes that additional funding will be required to implement improved monitoring as recommended by the HSRG.

LAKE WASHINGTON

Overview

HABITAT[98]

Out of the 692 square miles in Water Resource Inventory Area (WRIA) 8,607 are in the Cedar/Sammamish watershed, which contains two major river systems—the Cedar and the Sammamish—and three large lakes—Union, Washington and Sammamish. The remainder of the WRIA consists of numerous small watersheds that drain directly to Puget Sound between Elliott Bay and Mukilteo. Lake Washington is the second largest natural lake in the state, with about 80 miles of shoreline (including about 30 miles along the shore of Mercer Island) and a surface area of about 35.6 square miles. Arguably, Lake Washington has the most highly altered watershed on the West Coast. Despite such heavy alteration, it continues to support numerous salmon runs.

WRIA 8 is located predominantly within the borders of King County, but 15% of it extends northward into Snohomish County. To the west, it is bounded by Puget Sound, while to the east the headwaters of the Cedar River reach the crest of the Cascade Range near Stampede Pass). The northern and southern boundaries follow hilltops, ridges and plateaus that define the drainage's divides between the Snohomish/Snoqualmie (WRIA 7) and Green/Duwamish (WRIA 9) watersheds, respectively.

The Lake Washington watershed has been dramatically altered in the 150 years since the first Euro-American settlers arrived in the Seattle area. This started with heavy logging of old growth forest in the 19th Century. It expanded at the turn of the 20th Century, when Seattle tapped the Cedar River as its main source of water supply. A major alteration of the watershed occurred in the decade of 1910-20, when the Lake Washington Ship Canal and Hiram M. Chittenden Locks were completed. The ecological consequences of this last alteration were profound—the outlet of Lake Washington was redirected from its south end at the Black River. The new outlet, at the Locks and Salmon Bay, had almost no features of a natural estuary and presented migrating salmonids an abrupt transition from freshwater to saltwater (and saltwater to freshwater. The level of Lake Washington was dropped about nine feet, which drained wetlands along much of its shoreline and dramatically changed the confluences with its tributaries. In addition, cutthroat populations have flourished in this urbanized environment, resulting in significantly increased predation problems affecting anadromous species.

In a separate but related action in the same decade, the Cedar River was redirected from its normal connection with the Black River, which had fed the Duwamish, and was channelized to flow into Lake Washington, with the initial hope of creating a major freshwater industrial port at Renton. Lowering the water surface level of Lake Washington also lowered the water surface of Lake Sammamish and drained the vast wetland complex that had made up the Sammamish River Corridor between the two lakes. This provided the basis for a major expansion of farming in that corridor, which led to channelization of the Sammamish River in the early 1920s to nearly its present course. Thus, by the 1920s the general hydro-geography of the present watershed was established.

[98] *Salmon And Steelhead Habitat Limiting Factors Water Resource Inventory Area (WRIA) 8, Cedar/Sammamish Watersheds, Washington State Conservation Commission, September 2001.*

In the ensuing years, the most important cause of physical change to the watershed has been the expansion of urban and suburban development. In particular, this has altered the hydrology of the watershed; both through changes in land cover and through increased water withdrawals. Changes in land cover due to urbanization have been extensively shown to relate to degradations in salmon habitat, mostly due to changes in flows but also because of degraded riparian areas. The removal of forest cover for urban and suburban development dramatically increases the size and frequency of high flows from storm water in lowland creeks. It typically reduces low flows in the summer and early fall, because cleared land and impervious surfaces dramatically reduces groundwater recharge. As to increased water withdrawals, through the 1940s these were primarily from Seattle's Cedar River Watershed, but total withdrawals from the watershed have been relatively stable since then, as Seattle and the region have developed other supplies. Major groundwater withdrawals in the watershed since then have been from below the lower Cedar River, lower Issaquah Creek, lower Bear Creek and Rock Creek (a tributary to the Cedar River).

Following significant floods in the 1950s, countywide flood control efforts in the 1960s led to a dramatic expansion of levees on the Cedar River and local sponsorship of major dredging and levee construction on the Sammamish River by the Army Corps of Engineers. This in turn supported the greater development of the floodplains of both rivers. Meanwhile, expanding urbanization led to heavy residential development of the shorelines of Lake Washington and Lake Sammamish. Residential development has also expanded along the bluffs above Puget Sound and along parts of its shoreline. The marine nearshore of WRIA 8 was even more dramatically affected by the construction of a railroad line along most of its length early in the 20th Century. Bulkheads and other protections for the railroad line and developments have significantly curtailed natural, beach-forming ecological processes along the Puget Sound nearshore.

Land uses differ considerably across the watershed and there are few watersheds in the Puget Sound basin that match extremes evident in WRIA 8. In the upper Cedar River, land is devoted almost entirely to preservation of forests. A mix of residential, commercial forestry generally characterizes the smaller streams, and agricultural land uses. Residential, industrial, and commercial uses prevail in the lower reaches of virtually all the streams. The Puget Sound drainages are primarily residential in nature. Fundamental land use changes to the WRIA over the last 150 years include:

- 1840s and 1850s, European settlement begins
- 1880–1910, Logging across much of the watershed
- 1901, City of Seattle begins water diversions out of Cedar River
- 1916, Cedar River diverted into Lake Washington, Hiram M. Chittenden Locks finished, Lake Washington outlet changed to Salmon Bay
- 1945–present, Residential, commercial, and industrial uses replacing largely farmlands and forests in western half of WRIA

STOCK STATUS[99]

Stocks	Hatchery Program?	Biological Significance (L=Low, M =Intermediate, H =High)			Population Viability (L=Critical, M = At Risk, H = Healthy)			Habitat (L = Inadequate, M = Limiting, H = Healthy)			Harvest Opportunity (0 = None, L = Occasional, M = Most years, H = Each year)		
		Now	Goals		Now	Goals		Now	Goals		Now	Goals	
			Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term		Short-Term	Long-Term
Cedar River Chinook	N	M	M	H	M	M	H	L	L	M	L	L	M
North Lake Washington Chinook	N	M	M	M	L	L	M	L	L	L/M	L	L	L
Portage Bay Hatchery Chinook	Y	L	L	L	M	M	M	L	L	L	L	L	L
Issaquah Hatchery Chinook	Y	M	M	M	H	H	H	L	L	L	H	H	H
Portage Bay Hatchery Coho	Y	L	L	L	M	M	M	L	L	L	H	H	H
Lake Washington Coho	Y	L	L	L	L	L	L	L	L	L	H	H	H
Edmonds Net Pen Coho	Y	L	L	L	H	H	H	M	M	M	H	H	H
Lake Washington Sockeye	Y	M	M	M	M	M	H	M	M	M	M	M	H
Pipers Creek Chum	Y	L	L	L	L	L	L	L	L	L	L	L	L
Lake Washington Winter Steelhead	Y	M	M	M	L	L	M	L	L	L	0	0	L

Biological significance *is determined by considering a number of specific factors relating to stock origin, biological attributes and population subdivisions, with the stock defined as being of either* low, intermediate *or* high *significance.*

Population viability *is determined by considering a number of specific factors such as age class structure, spawner escapement and proportion of hatchery-origin fish in natural spawning, with the stock's viability defined as being either* critical, at risk *or* healthy. *This rating refers to the stock's ability to sustain itself in the natural environment (except in the case of a segregated harvest program, in which case the ratings are* low, medium *and* high *and refer to the stock's ability to sustain itself in the culture environment).*

The stock's spawning, freshwater, migration and estuarine ***habitat*** *is rated as either* inadequate *(target stock is unproductive and the population will go extinct, even without terminal harvest),* limiting *(target stock is productive enough for the population to sustain itself at a low level terminal harvest) or* healthy *(productivity of the stock is high and the population is capable of growth and supporting significant terminal harvest).*

Harvest opportunity *is rated according to whether the goal is to provide* no *directed harvest opportunity,* occasional *opportunity, opportunity* most years*, or opportunity* each year.

HATCHERIES

Portage Bay Hatchery[100]

The Portage Bay Hatchery is located at the University of Washington (UW) College of Fisheries on the shores of Portage Bay. The program has two major goals and missions: 1) support research programs by University of Washington faculty, research scientists, graduate students and other affiliated research organizations such as NMFS, US Geological Survey and WDFW; and 2) support educational activities for undergraduate and graduate students within the UW and also K-12 outreach opportunities for Puget Sound region schools. The hatchery is equipped to trap, spawn, incubate, rear and release sufficient numbers of fish for educational and research purposes as well as releasing sufficient numbers of smolts to assure broodstock self-sufficiency. Portage Bay hatchery uses three different water sources to rear fish. The primary source for the facility is surface water drawn from Portage Bay. A well water source and domestic (city water) source are also utilized, depending on time of year, fish life stage and research needs. In addition, the facility has a limited ability to warm surface water drawn from Portage Bay. Portage Bay Hatchery rears Portage Bay chinook and coho.

[99] *This table contains ratings for all the salmonid stocks in the sub-region, as provided by the managers. For a more detailed definition of these ratings, see HSRG Scientific Framework and Hatchery Review Program, Benefit/Risk Tool chapter.*

[100] *Information provided by Darrell Mills, WDFW, August 2002.*

Issaquah Creek Hatchery[101]

Issaquah Creek Hatchery is located on Issaquah Creek, approximately three miles upstream from its confluence with Lake Sammamish. Issaquah Hatchery is unique in that it is situated in the heart of an urban area, downtown Issaquah. The facility is operated by WDFW and financed through the State General Fund. Three phases of reconstruction have recently been completed. The facility has two residences, a shop, an incubation building consisting of a three vertical incubation rooms, shallow trough and intermediate rearing capabilities, office/storage, break room and two class study rooms. The facility also has an adult spawning shed, educational Watershed Science Center and two large adult viewing platforms, bridge and viewing windows. The incubation building is comprised of 54 full stack vertical incubators, shallow and intermediate troughs that can be supplied with creek, well and/or chilled well water. Outside ponds consist of two 20' x 90' x 4', eight 10' x 9'0 x 4', two 20' x 80' x 5', four 10' x 80' x 3.5' rearing ponds and two 10' x 90' x 5' adult holding ponds. The facility has an upper gravity and lower pump intake. The gravity intake predominantly supplies water to the north side of the facility and the pump intake drives water to the south side. Incubation water may be supplied with creek, well or chilled well water. The hatchery rears Issaquah Creek chinook, Issaquah Creek coho and Lake Washington steelhead, and handles Issaquah Creek chinook, Issaquah Creek coho, Issaquah Creek sockeye, Issaquah Creek cutthroat, Issaquah Creek rainbow and Lake Washington steelhead.

Cedar River Hatchery[102]

The Cedar River Hatchery is located within the 650 square-mile City of Seattle Municipal Watershed at river mile 21.8 on the Cedar River. The facility is owned by the City of Seattle and operated by WDFW. The project is financed with Seattle Public Utilities mitigation funds. The Cedar River Project began in September 1991, with an egg take goal of approximately three million. After several upgrades and remodels, the hatchery currently has the total capacity of incubating 18 million fry. At the adult holding ponds (river mile 21.4) there are four circular ponds 13' x 3.5' and four fiberglass intermediates that are 16' x 3' and a small 10' x 10' storage shed. The hatchery has a permanent 20' x 20'fertilization and disinfection room. There are two covered areas that are used for incubation (banks A and B). Bank A contains 24 Kitoi Incubation boxes. Bank B contains 29 Kitoi Boxes,. A cargo container has been converted into an incubation room that holds 20 half–stack, vertical flow incubators. There are two cargo containers used for storage of tools and supplies. A 20' travel trailer is used for an office and break room. A 26' travel trailer is used as a residence for stand-by personnel. Refrigerated water used for otolith marking is generated from a series of chillers. Cedar River Hatchery rears Cedar River sockeye and Lake Washington winter steelhead (incubation only).

Ballard Net Pen[103]

The Ballard Net Pen is located at the Shilshole Bay Marina in Ballard, northwest Seattle. The project is a cooperative effort between WDFW and the Ballard Salmon Club. The project has been in operation for over 20 years and is financed through the Aquatic Lands Enhancement Account. The site was originally used to rear delayed-release chinook, but that program has been dropped due to concerns about adults straying into the watersheds of the region. The site currently rears only coho smolts. The stock reared is Soos Creek coho. The release site is within 0.5 miles of the entrance to the Ballard Locks.

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[101] *Information provided by Larry Klube, WDFW, August 2002.*

[102] *Information provided by Brodie Antipa, WDFW, August 2002.*

[103] *Information provided by Darrell Mills, WDFW, August 2002.*

Edmonds Net Pen[104]

The Edmonds Net Pen is located at the Laebugten Wharf in the City of Edmonds. The project is a cooperative effort between WDFW and the Northwest Salmon and Steelhead Council, Laebugten Chapter. The project has been in operation for over 20 years and is financed through the Aquatic Lands Enhancement Account. The site was originally used to rear delayed-release chinook, but that program has been dropped due to concerns about adults straying into the watersheds of the region. The site currently rears only coho smolts. The stock reared is Issaquah coho.

[104] *Ibid.*

Portage Bay Hatchery Chinook

University of Washington and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[105]	Medium	Medium	Medium
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Occasional	Occasional	Occasional
Hatchery Program:			
Purpose	Research and Education		
Type	Segregated		

PROGRAM DESCRIPTION

The Portage Bay hatchery chinook program began in 1949 with Green River origin chinook. Other stocks in addition to Green River have likely been transferred here. Portage Bay adult returns maintain this program. Portage Bay hatchery chinook belong to the South Puget Sound, Hood Canal and Snohomish Summer and Fall GDUs. 180,000 fingerlings are released at 22 fish per pound on-station into Portage Bay in late May. Adult collection, spawning, incubation and rearing occur on-station. The source of this stock was 60,000 from Portage Bay and 120,000 from Grovers Creek. The two stocks are differentially marked. 60,000 eyed eggs are transferred to regional cooperatives.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is consistent with its educational goals.

B. Likelihood of attaining goals?
This program provides opportunities for University of Washington researchers, in addition to educational benefits for collegiate and public school programs. It provides a minor harvest opportunity.

C. Consistent with goals for other stocks?
The program is generally consistent with the goals for other Lake Washington stocks. There is a straying risk that should be evaluated. The large size at release may suggest a risk of predation on other stocks.

[105] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

RECOMMENDATIONS

- Conduct marking and evaluation more consistently, enough to evaluate straying.
- Use Issaquah chinook if the program changes broodstocks.
- Evaluate lake residualism and predation, due to large size at release.
- Improve pollution abatement at the facility to meet water quality standards.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Issaquah Hatchery Chinook

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability[106]	High	High	High
Habitat	Inadequate	Inadequate	Inadequate[107]
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Education		
Type	Segregated		

PROGRAM DESCRIPTION

The Issaquah Hatchery chinook program began in 1937 with Green River chinook. Issaquah last received eggs from Green River Hatchery in 1992. Adults trapped at the Issaquah Hatchery have maintained this program since that time. Issaquah hatchery chinook belong to the South Puget Sound, Hood Canal and Snohomish Summer and Fall GDUs. Two million fingerlings are released on-station into Issaquah Creek. Adult collection, spawning, incubation and rearing occur on-station. Adults are also passed above the rack to spawn in Issaquah Creek.

OPERATIONAL CONSIDERATIONS

- This facility has been under reconstruction for the past few years and is nearly complete.
- Fish are not coded wire tagged.
- Returns to the hatchery are currently surplus to hatchery broodstock needs because of a lack of a satisfactory level of harvest.
- The facility features a strong educational component for both salmon life history and watershed stewardship.
- This facility suffers significant egg and fry mortality due to silt in the incubators.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program is consistent with the goals for the stock.

[106] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

[107] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

B. Likelihood of attaining goals?
The program is providing for limited harvest. Educational goals are being met.

C. Consistent with goals for other stocks?
The program is generally consistent with the goals for other Lake Washington stocks. However, there is a potential risk of fish from this program straying into the Cedar River and other Lake Washington tributaries.

RECOMMENDATIONS

- Mark/tag fish to evaluate potential straying and contribution to harvest.
- Ensure all management and hatchery staff can accurately describe program goals, given the facility's educational function.
- Explore the opportunity to increase harvest. If harvest is not increased, adjust the program size accordingly.
- Consider the development of a larger hatchery carcasses nutrient enhancement program in tributaries.
- Upgrade the water incubation system to include the appropriate number of sand filters.

COMMENTS

- The lower Canadian fishing rate may be temporarily contributing to the excess return.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, , but notes that additional funding will be required to improve the facilities. Consistent with the HSRG recommendations, WDFW has initiated marking and tagging of this stock.

Portage Bay Hatchery Coho

University of Washington and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[108]	Medium	Medium	Medium
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Research and Education		
Type	Segregated		

PROGRAM DESCRIPTION

The Portage Bay hatchery coho program began with fish from multiple sources (Soos Creek, Issaquah, and other hatcheries). The University of Washington maintains the program from returns to the Portage Bay facility. 90,000 zero-plus coho are released on-station into Portage Bay. Adult collection, spawning, incubation and rearing occur on-station. This is an unusual release of zero-age coho at 30 fish per pound in May. This program provides 27,000 eyed eggs to regional watershed groups for educational purposes.

OPERATIONAL CONSIDERATIONS

- Year-round rearing is generally not possible because of elevated lake water temperatures in July, August and early September.
- This program produces almost exclusively two year-old spawners, an artificially selected life history.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program provides opportunities for University of Washington researchers, in addition to educational benefits for collegiate and public school programs. The program provides a minor harvest opportunity.

B. Likelihood of attaining goals?
The program is providing research and educational opportunities.

C. Consistent with goals for other stocks?
The program is generally consistent with goals for other Lake Washington stocks. There are straying and predation risks.

[108] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

RECOMMENDATIONS

- Conduct tagging and evaluation more consistently, enough to evaluate straying and survival.
- Use Issaquah coho if the program changes broodstocks.

COMMENTS

- None.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Lake Washington Coho

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability	Critical	Critical	Critical
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest and Education		
Type	Integrated		

PROGRAM DESCRIPTION

Since its inception in 1936, the Issaquah Hatchery coho program has relied on locally collected adults and fish transplants from Green River Hatchery. 450,000 yearlings are released on-station at Issaquah Creek Hatchery, with ~1.2 million eggs outplanted from schools and volunteer projects into the drainage. Adults are also passed above the rack, to spawn in Issaquah Creek. Adult collection, spawning, incubation and rearing occur at Issaquah. Adult returns have in the past been supplemented with Green River fish, though this has not occurred for 20 years. Adults are outplanted into Tibbets and Coal creeks. This could be expanded in the future. The Ballard Net Pen coho program is also maintained with fish from this program. The Ballard Net Pen is a cooperative program between WDFW and the Ballard Salmon Club, which began in 1988. 25,000 yearlings are released into Puget Sound (Shilshole Bay) from marine net pens. Adult collection, spawning, incubation and rearing prior to salt water transfer occur at Issaquah Creek.

OPERATIONAL CONSIDERATIONS

- This facility has been under reconstruction for the past few years and is nearly complete.
- These fish are not coded wire tagged
- This program features a strong educational component for both salmon life history and watershed stewardship.
- This facility suffers significant egg and fry mortality due to silt in the incubators.
- Fish are not released volitionally.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is consistent with the goals for the stock. It provides both a harvest and an educational benefit. It does create a competition risk with natural coho. The Ballard net pen releases provide some harvest benefits, but those benefits have not been quantified.

B. Likelihood of attaining goals?
The program is providing for limited harvest. Educational goals are being met. The potential straying risks from the Ballard net pen releases are perceived to be minimal, because of the small size of these releases and the low biological significance of Lake Washington coho.

C. Consistent with goals for other stocks?
There is a predation risk to chinook, sockeye and kokanee that may be exacerbated by forced releases leading to slower outmigration. There is also a risk of genetic divergence from the natural spawning population, due to a lack of known natural-origin recruits in the hatchery broodstock. There could be a potential risk from the Ballard net pen releases associated with attracting predators that affect other Lake Washington stocks, because of the proximity of the release site to the Ballard Locks.

RECOMMENDATIONS

- Mark/tag fish to evaluate potential straying and contribution to harvest.
- Develop a plan to identify natural-origin recruits and incorporate them into hatchery broodstock.
- Incorporate all segments of the run into broodstock representatively.
- Continue evaluation of semi-natural rearing. Add some educational signage about this element of the program.
- Upgrade the water incubation system to include the appropriate number of sand filters.
- Implement a volitional release program to reduce the predation risk to chinook, sockeye and kokanee.
- Put excess adult coho into tributaries as an alternative to fry plants in underused areas, and for nutrient enhancement.
- Continue to mark all fish released from the Ballard net pens.

COMMENTS

- Temporal selection of late returning adults for cooperatives may create a risk to maintaining run timing.

MANAGERS RESPONSE

WDFW generally supports the recommendations of the HSRG, but notes that:
- Additional funding will be required for coded-wire-tagging and assessment of straying; and
- Additional funding will be required to improve the facilities.

Edmonds Net Pen Coho

Northwest Salmon and Steelhead Council and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[109]	High	High	High
Habitat	Limiting	Limiting	Limiting
Harvest Opportunity	Each Year	Each Year	Each Year
Hatchery Program:			
Purpose	Harvest		
Type	Segregated		

PROGRAM DESCRIPTION

The Edmonds net pen coho program began in 1990 with fish transplanted from the Marblemount Hatchery. More recently, this program has been maintained with juvenile fish from the Issaquah Creek Hatchery. 25,000 yearlings are released into Puget Sound from marine net pens at the city of Edmonds. Adult collection, spawning, incubation and rearing prior to salt water transfer occur at Issaquah Creek.

OPERATIONAL CONSIDERATIONS

- These fish are adipose fin clip marked, but not coded wire tagged.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program provides some harvest benefits, but those benefits have not been quantified.

B. Likelihood of attaining goals?
The program is likely to continue providing some level of harvest.

C. Consistent with goals for other stocks?
A potential straying risk exists into the Snohomish River system.

RECOMMENDATIONS

- Continue to mark all released fish.
- Periodically monitor and evaluate the contribution of adult returns to harvest and straying.

[109] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

COMMENTS

- None.

MANAGERS RESPONSE

WDFW generally supports the recommendations of the HSRG, but notes that additional funding will be required for coded-wire-tagging and assessment of straying.

Lake Washington Sockeye

City of Seattle and Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability	At Risk	At Risk	Healthy
Habitat	Limiting	Limiting	Limiting[110]
Harvest Opportunity	Most Years	Most Years	Each Year
Hatchery Program:			
Purpose	Harvest and Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

This program started in 1991 with naturally spawning fish returning to the Cedar River. The program is now maintained with adults returning to the Cedar River but their origin (hatchery-enhanced or wild) is uncertain. The Lake Washington/Cedar River sockeye were introduced from the Baker River, Washington, beginning in 1935 and from Cultus Lake, Canada, in 1944, 1950 and 1954. The population has maintained itself, without further introductions, since 1955. This population is the only one in the Cedar River Sockeye GDU.

The purposes of the program are both conservation and harvest. The Cedar River Sockeye population is descended from sockeye transplanted into the Lake Washington basin after the outlet of the Lake was artificially changed early in the last century and has naturally colonized the Cedar River. It is the largest sockeye population in the Puget Sound/western Washington region and the primary source of harvestable sockeye in the Lake Washington recreational fishery. Harvest occurs most years. Harvest may be possible each year with the full development of the hatchery program.

The future hatchery program is specified in the recently-signed, 50-year Habitat Conservation Plan, a legal agreement between city, state and federal governments. The program will mitigate potential spawning habitat not available because of the reservoir and Landsberg Dam. The plan sets production levels, on a sliding scale, so as not to overwhelm natural production. The HSRG reviewed the program as it presently exists, recognizing that there are well-developed plans to increase production with a new facility. Where the HSRG had concerns with the present program, particular attention was paid to the plan, to see whether they were adequately treated.

From nine million to 17.2 million unfed fry are released at four sites (river mile 28.1 - hatchery, river mile 13.5, river mile 1.2, river mile 0.1). Adult collection is at a weir located at river mile 6.3 on the Cedar River. Spawning and incubation occur at the Cedar River Hatchery. The planned program will

[110] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

expand the range of releases up to 34 million unfed fry. The program is designed to integrate the hatchery-spawned and naturally-spawning segments of the population such that they freely interbreed with one another and that domestication and other effects of hatchery culture are minimized. The hatchery broodstock is planned to include both hatchery-origin and natural-origin spawners and is designed so that hatchery-origin recruits will contribute to natural reproduction without detriment to the natural-origin segment of the population.

OPERATIONAL CONSIDERATIONS

- The operating plan of the hatchery would mix hatchery-origin and natural-origin recruits in the broodstock randomly with respect to proportion in the run. Egg takes are scaled to the size of the run, with the assumption of a significant post-release survival handicap associated with hatchery, so that the run is not more than about one-half hatchery-origin in years of abundance. Broodstock are not directly screened with respect to origin, but mass-marking enables post-season evaluation.
- The plan is designed to represent all temporal segments of the run in broodstock. However, the broodstock weir washes out early each year, and late-returning salmon have not been sampled proportionately.
- The hatchery plan is designed to emulate natural fry production that would occur in the river, releasing unfed fry into the river at a natural developmental stage. However, embryonic development is in spring water, which is warmer than intra-gravel water and fry complete development earlier than they would in nature.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
The program provides a demographic benefit, but the primary benefit is to harvest. This is a mitigation facility that is using conservation technology to achieve a harvest benefit.

B. Likelihood of attaining goals?
Given the current management structure, there is a high probability of this program providing additional fish for harvest. The present weir and incubation facilities limit the ability of the program to attain harvest goals.

C. Consistent with goals for other stocks?
There may be ecological risks (competition, predation, pathogens) to chinook and other sockeye stocks. There is evidence that the carrying capacity of the lake is not challenged by present natural and hatchery sockeye production .The hatchery plan makes this the subject of continuing monitoring and assessment.

RECOMMENDATIONS

- Given that the primary design criterion for the program is to emulate the natural life history of sockeye in the Cedar River/Lake Washington system, the hatchery managers should:
  - Take broodstock randomly from the run. The plan for the future hatchery accounts for this, but it remains to be seen whether the planned facility for collecting broodstock will be capable of sampling late-returning sockeye.
  - Adjust incubation temperature to a natural pattern. The HSRG notes that plans for the future entail chilling of incubation water to accomplish this purpose.
  - Carry out plans to monitor, evaluate and adapt the program. Change the program as its biological performance is better understood in the future.

- Continue to mark all fry, in keeping with this adaptive management plan.
- Carry out plans to monitor the production of fry in the lake (their abundance, growth and origin) and the production of smolts from the lake (their abundance, age, size and origin). Also, monitor the abundance, growth and survival of competitors and predators.

COMMENTS

- Dispose of carcasses aseptically. The marginal nutrification benefit from the hatchery carcasses will be small when added to the nutrification derived from naturally spawning carcasses. There can be no public question of whether the IHN-V virus is artificially increased in the system by carcass disposal if carcasses are not deposited in the River.
- Adaptive management is a hallmark of the proposed plan for the program and is based on considerable research. The program provides a research tool for understanding the fate of sockeye in the Lake Washington system by its ability to mark fry, mass mark the stock and differentially mark components of it through otolith thermal marks.
- In conjunction with the new hatchery, the managers should review the current harvest management policy and whether a fixed escapement goal of 350,000 sockeye is appropriate.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes that funding will be required for marking, program evaluation, and to monitor the abundance, growth and survival of competitors and predators.

Pipers Creek Hatchery Chum

Carkeek Watershed Community Action Project, local tribes, Washington Department of Fish and Wildlife, Seattle Parks Department, and Seattle Public Utilities

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Low	Low	Low
Population Viability[111]	Low	Low	Low
Habitat	Inadequate	Inadequate	Inadequate
Harvest Opportunity	Occasional	Occasional	Occasional
Hatchery Program:			
Purpose	Education		
Type	Segregated		

PROGRAM DESCRIPTION

This program was started in 1980 with coho smolts from the University of Washington. In 1984, the program was eliminated and replaced with chum fry from Minter Creek Hatchery in the South Sound region. Adult returns to the hatchery and John's Creek fall chum (Minter Creek) currently maintain this program. This stock is one of five stocks in the Central/South Puget Sound Fall Chum GDU. 70,000 fry are released from an acclimation tank on Pipers Creek. Adult collection, spawning and incubation occur at Minter Creek.

OPERATIONAL CONSIDERATIONS

- None.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
This program provides educational benefit.

B. Likelihood of attaining goals?
The program's goals are being attained.

C. Consistent with goals for other stocks?
The program is consistent with goals for other stocks.

RECOMMENDATIONS

- Switch broodstock to Cowling Creek Hatchery chum.

[111] *In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.*

COMMENTS

- This is a good example of an educational program.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG.

Lake Washington Winter Steelhead

Washington Department of Fish and Wildlife

Stock Goals:	Current	Short-Term	Long-Term
Biological Significance	Medium	Medium	Medium
Population Viability	Critical	Critical	At Risk
Habitat	Inadequate	Inadequate	Inadequate[112]
Harvest Opportunity	None	None	Occasional
Hatchery Program:			
Purpose	Conservation		
Type	Integrated		

PROGRAM DESCRIPTION

Since its inception in 1997, the Lake Washington winter steelhead program has used natural fish returning to the Ballard Locks as broodstock. This is not an on-going program, because too few adults were captured in the last few years to maintain the program. This was an experimental program and juveniles produced from it were planted into north Lake Washington (Sammamish Basin) tributaries. Lake Washington hatchery winter steelhead belong to the South Puget Sound GDU. Up to 20,000 yearlings are intended to be released on-station at Issaquah Creek Hatchery. Adults are held and spawned and eggs are eyed at the Cedar River Hatchery. Hatching and rearing occur at Issaquah. Up to 30,000 fingerlings are also released into north tributaries, because of late arrivals and to test the results of different timing strategies.

OPERATIONAL CONSIDERATIONS

- 75 adults must return to Ballard Locks for the program to occur.
- Issaquah Creek Hatchery released fish at 9.5 per pound in May 2000.
- Juveniles appear to be residualizing in Lake Washington.
- The parasite *Ceratomyxa shasta* was recently observed in the Cedar River and Bear Creek and may be related to the decline of this stock.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?
A conservation program is warranted with such low numbers of returning adults.

B. Likelihood of attaining goals?
The likelihood of attaining goals is highly doubtful with the present program design, coupled with

[112] *The HSRG understands that the co-managers are currently in the process of attempting to resolve the particularly difficult challenge of assessing long-term habitat status in this sub-region, taking into account intense development pressures and other potentially negative impacts, alongside potential habitat improvement projects. The HSRG believes its recommendations for this program are valid despite this uncertainty.*

unknown and potential problems associated with *Ceratomyxa*.

C. Consistent with goals for other stocks?
The program is probably too small to pose significant risks to other stocks.

RECOMMENDATIONS

- Discontinue using adults from the Ballard Locks until uncertainties associated with *Ceratomyxa* have been addressed. Address these uncertainties by:
    - Using susceptible sentinel fish to test locations within the Cedar River/Lake Washington Basin to locate sources of the parasite. PCR methodology ("DNA fingerprinting") has been previously used to detect disease presence. The WDFW fish health lab now has PCR equipment (from Hatchery Reform Project funding).
    - Testing various wild stocks of salmonids found within the watershed for susceptibility to the disease.
    - Testing the Green River stock of hatchery and wild fish for susceptibility, as candidate stocks for introduction into Lake Washington.

COMMENTS

- Numbers of returning adults warrants strong intervention actions, but potential problems with *Ceratomyxa* need to be identified prior to deciding what options are available.

MANAGERS RESPONSE

WDFW supports the recommendations of the HSRG, but notes that funding will be required to implement the research and monitoring program.

FACILITY RECOMMENDATIONS

Assembled below are the Hatchery Scientific Review Group's recommendations that involve capital improvements at hatchery facilities in the Central Puget Sound region.

Puyallup River

DIRU CREEK HATCHERY

- Construct an acclimation and adult collection pond with adequate attraction to reduce straying of fish released from Diru Creek.
- Develop a covered spawning area.
- Develop a pollution abatement facility.

VOIGHTS CREEK HATCHERY

- Address the need for pollution abatement ponds and adult holding and collection facilities.
- Improve juvenile downstream passage at Electron Dam.
- Consider semi-natural rearing to increase survival and perhaps reduce domestication.
- Create a surface water pre-settling pond.
- Upgrade the pumps, intakes and pipeline.

East Kitsap

GROVERS CREEK HATCHERY

- Secure reliable, adequate incubation water at Grovers Creek, via redeveloping well water or other means.
- Develop a formalin treatment tank or pond at Grovers Creek.
- Develop incubation facilities at Grovers Creek or Gorst Creek, to eliminate transfer.

Green River

SOOS CREEK HATCHERY

- Design and construct an adult holding and sorting pond that is not in the mainstem of Soos Creek. This new facility should include bypass facilities for efficiently passing adult fish upstream, and a weir for diverting upstream migrating fish into the holding pond.
- Create elevated or moved raceways.
- Include bird netting.
- Include educational signage, etc.
- Upgraded the pollution abatement system.
- Develop a pre-settling pond for the intake.

ICY CREEK POND

- Develop adult collection capability. This could be accomplished by constructing adult recapture facilities at Icy Creek and Newaukum Creek.
- Institute predator control methods.

PALMER PONDS

- Institute predator control methods.

KETA CREEK HATCHERY

- Develop filtration facilities for incubation.
- Upgrade facility supply line, to improve water supply. security

CRISP CREEK HATCHERY

- Modify the yearling program to allow collection of returning adults.
- Improve predator controls and bird netting.
- Improve the supply and discharge system to eliminate tributary supply and to bypass draw-down effluent below stream intake.

Lake Washington

PORTAGE BAY HATCHERY

- Improve pollution abatement at the facility to meet water quality standards.

ISSAQUAH CREEK HATCHERY

- Upgrade the water incubation system to include the appropriate number of sand filters.
- Include a pre-settling pond with intake system.

CEDAR RIVER HATCHERY

- Include temperature control equipment.
- Develop a permanent adult trapping and holding facility to allow collection of a better representation of the total run timing, and ensure safety of the crew operating the trap.
- Rebuild the main water supply lines at the Cedar River adult ponds.
- Include a formalin system for every incubation vessel.
- Provide underground and insulated plumbing to the stand-by residence, fertilization shed and office trailer
- Include educational signage.

❖Appendices

Appendix A: Puget Sound and Coastal Stocks and the Genetic Diversity Units to Which They Belong[113]

Stock	GDU
Chinook	
North Fork Nooksack Chinook	North Fork Nooksack Spring Chinook
South Fork Nooksack Chinook	South Fork Nooksack Spring Chinook
Samish/Mainstem Nooksack Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Upper Skagit Mainstem/Tributaries Summer Chinook	Stillaguamish and Skagit Chinook
Lower Skagit Mainstem/Tributaries Fall Chinook	Stillaguamish and Skagit Chinook
Lower Sauk Summer Chinook	Stillaguamish and Skagit Chinook
Upper Sauk Spring Chinook	Stillaguamish and Skagit Chinook
Suiattle Spring Chinook	Stillaguamish and Skagit Chinook
Upper Cascade Spring Chinook	Stillaguamish and Skagit Chinook
Stillaguamish Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Stillaguamish Summer Chinook	Stillaguamish and Skagit Chinook
Snohomish Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Snohomish Summer Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Bridal Veil Creek Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Wallace Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
North Lake Washington Tribs Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Issaquah Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Cedar Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Duwamish/Green Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Green System (tentative) Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Newaukum Creek Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Puyallup Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
White (Puyallup) Spring Chinook	South Puget Sound Spring Chinook
White (Puyallup) Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Nisqually Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Skokomish Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Hamma Hamma Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Duckabush Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Dosewallips Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Dungeness Spring/Summer Chinook	Eastern Strait Chinook

[113] *A genetic diversity unit (GDU) is a group of genetically similar stocks that is genetically distinct from other such groups. The stocks typically exhibit similar life histories and occupy ecologically, geographically, and geologically similar habitats. No GDUs exist for coho, cutthroat or dolly varden. Information provided by Washington State Department of Fish and Wildlife staff; GDU information is based on Busack, C. and J. B. Shaklee. 1995. Genetic Diversity Units and Major Ancestral Lineages of Salmonid Fishes in Washington. Washington State Department of Fish and Wildlife, Technical Report No. RAD 95-02.*

Elwha/Morse Creek Summer/Fall Chinook	Eastern Strait Chinook
Hoko Fall Chinook	Western Strait Chinook
Sooes Fall Chinook	North Coast Fall Chinook
Sol Duc Fall Chinook	North Coast Fall Chinook
Sol Duc Spring Chinook	North Coast Spring Chinook
Sol Duc Summer Chinook	North Coast Spring Chinook
Quillayute/Bogachiel Fall Chinook	North Coast Fall Chinook
Quillayute/Bogachiel Summer Chinook	North Coast Spring Chinook
Dickey Fall Chinook	North Coast Fall Chinook
Calawah Fall Chinook	North Coast Fall Chinook
Calawah Summer Chinook	North Coast Spring Chinook
Hoh Fall Chinook	North Coast Fall Chinook
Hoh Spring/Summer Chinook	North Coast Spring Chinook
Queets Fall Chinook	North Coast Fall Chinook
Queets Spring/Summer Chinook	North Coast Spring Chinook
Clearwater Fall Chinook	North Coast Fall Chinook
Clearwater Spring/Summer Chinook	North Coast Spring Chinook
Raft Fall Chinook	North Coast Fall Chinook
Quinault Fall Chinook	North Coast Fall Chinook
Quinault Spring/Summer Chinook	North Coast Spring Chinook
Cook Creek Fall Chinook	North Coast Fall Chinook
Moclips Fall Chinook	North Coast Fall Chinook
Copalis Fall Chinook	North Coast Fall Chinook
Humptulips Fall Chinook	South Coast Fall Chinook
Hoquiam Fall Chinook	South Coast Fall Chinook
Chehalis Fall Chinook	South Coast Fall Chinook
Chehalis Spring Chinook	Chehalis Spring Chinook
Wishkah Fall Chinook	South Coast Fall Chinook
Wynoochee Fall Chinook	South Coast Fall Chinook
Satsop Fall Chinook	South Coast Fall Chinook
Satsop Summer Chinook	Chehalis Spring Chinook
Johns/Elk and South Bay Tributaries Fall Chinook	South Coast Fall Chinook
Fall River Early (North River) Fall Chinook	South Coast Fall Chinook
Willapa Bay Fall Chinook	South Coast Fall Chinook
Hood Canal Sum/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
South Sound Tributaries Summer/Fall Chinook	South Puget Sound, Hood Canal and Snohomish Summer + Fall Chinook
Sockeye	
Baker Sockeye	Baker Sockeye
Lake Washington/Sammamish Tributaries Sockeye	Lake Washington River Spawners Sockeye
Lake Washington Beach Spawning Sockeye	Lake Washington Beach Spawners Sockeye
Cedar Sockeye	Cedar Sockeye
Ozette Sockeye	Ozette Sockeye
Lake Pleasant Sockeye	Lake Pleasant Sockeye
Quinault Sockeye	Quinault Sockeye

Wenatchee Sockeye	Wenatchee Sockeye
Okanogan Sockeye	Okanogan Sockeye
Chum	
North Fork Nooksack Fall Chum	Northern Puget Sound Fall Chum
Mainstem/South Fork Nooksack Fall Chum	Northern Puget Sound Fall Chum
Samish/Independents Fall Chum	Northern Puget Sound Fall Chum
Mainstem Skagit Fall Chum	Northern Puget Sound Fall Chum
Lower Skagit Tributaries Fall Chum	Northern Puget Sound Fall Chum
Sauk Fall Chum	Northern Puget Sound Fall Chum
North Fork Stillaguamish Fall Chum	Northern Puget Sound Fall Chum
South Fork Stillaguamish Fall Chum	Northern Puget Sound Fall Chum
Skykomish Fall Chum	Northern Puget Sound Fall Chum
Snoqualmie Fall Chum	Northern Puget Sound Fall Chum
Wallace Fall Chum	Northern Puget Sound Fall Chum
Duwamish/Green Fall Chum	Central/South Puget Sound Fall Chum
Crisp Creek Fall Chum	Central/South Puget Sound Fall Chum
Hylebos Creek Fall Chum	Central/South Puget Sound Fall Chum
Fennel Creek Fall Chum	Central/South Puget Sound Fall Chum
Puyallup/Carbon Fall Chum	Central/South Puget Sound Fall Chum
Nisqually Winter Chum	South Puget Sound Winter Chum
Chambers Creek Summer Chum	South Puget Sound Summer Chum
Chambers Creek Winter Chum	South Puget Sound Winter Chum
Skookum Inlet Fall Chum	Central/South Puget Sound Fall Chum
Upper Skookum Creek Fall Chum	Central/South Puget Sound Fall Chum
Johns/Mill Creeks Fall Chum	Central/South Puget Sound Fall Chum
Gig Harbor/Ollala Creek Fall Chum	Central/South Puget Sound Fall Chum
Blackjack Creek Summer Chum	Central/South Puget Sound Fall Chum
Dyes Inlet/Liberty Bay Fall Chum	Central/South Puget Sound Fall Chum
Big Beef Creek Summer Chum	Hood Canal Summer Chum
Anderson Creek Summer Chum	Hood Canal Summer Chum
Dewatto Fall Chum	Central/South Puget Sound Fall Chum
Dewatto Summer Chum	Hood Canal Summer Chum
Tahuya Summer Chum	Hood Canal Summer Chum
Union Summer Chum	Hood Canal Summer Chum
Sinclair Inlet Fall Chum	Central/South Puget Sound Fall Chum
Skokomish Summer Chum	Hood Canal Summer Chum
Upper Skokomish Late Fall Chum	Hood Canal Fall Chum
Lower Skokomish Fall Chum	Hood Canal Fall Chum
Finch Creek Summer Chum	Hood Canal Summer Chum
Lilliwaup Creek Summer Chum	Hood Canal Summer Chum
Hamma Hamma Summer Chum	Hood Canal Summer Chum
Hamma Hamma Late Fall Chum	Hood Canal Fall Chum
Duckabush Late Fall Chum	Hood Canal Fall Chum
Duckabush Summer Chum	Hood Canal Summer Chum

Dosewallips Summer Chum	Hood Canal Summer Chum
Dosewallips Late Fall Chum	Hood Canal Fall Chum
Quilcene Late Fall Chum	Hood Canal Fall Chum
Quilcene Summer Chum	Hood Canal Summer Chum
Big Quilcene Summer Chum	Hood Canal Summer Chum
Little Quilcene Summer Chum	Hood Canal Summer Chum
Chimacum Creek Summer Chum	Discovery Bay and Sequim Bay Summer Chum
Dungeness Summer Chum	Strait of Juan de Fuca Summer Chum
Dungeness/East Strait Tributaries Fall Chum	Strait of Juan de Fuca Fall Chum
Elwha Fall Chum	Strait of Juan de Fuca Fall Chum
Lyre Fall Chum	Strait of Juan de Fuca Fall Chum
Pysht Fall Chum	Strait of Juan de Fuca Fall Chum
Hoko/Clallam/Seiku Fall Chum	Strait of Juan de Fuca Fall Chum
Sooes Fall Chum	North Coast Washington Fall Chum
Ozette Fall Chum	North Coast Washington Fall Chum
Quillayute Fall Chum	North Coast Washington Fall Chum
Hoh Fall Chum	North Coast Washington Fall Chum
Queets Fall Chum	North Coast Washington Fall Chum
Quinault Fall Chum	North Coast Washington Fall Chum
Humptulips Fall Chum	South Coast Washington Fall Chum
Chehalis Fall Chum	South Coast Washington Fall Chum
North River Fall Chum	South Coast Washington Fall Chum
Willapa Fall Chum	South Coast Washington Fall Chum
Palix Fall Chum	South Coast Washington Fall Chum
Nemah Fall Chum	South Coast Washington Fall Chum
Naselle Fall Chum	South Coast Washington Fall Chum
Bear Fall Chum	South Coast Washington Fall Chum
Case Inlet Fall Chum	Central/South Puget Sound Fall Chum
Case Inlet Summer Chum	South Puget Sound Summer Chum
Deep Creek/East Twin/West Twin Fall Chum	Strait of Juan de Fuca Fall Chum
Snow Creek/Salmon Creek Summer Chum	Discovery Bay and Sequim Bay Summer Chum
Eld Inlet Fall Chum	Central/South Puget Sound Fall Chum
Goldsborough Creek/Shelton Creek Fall Chum	Central/South Puget Sound Fall Chum
Hammersley Inlet Summer Chum	South Puget Sound Summer Chum
Henderson Inlet Fall Chum	Central/South Puget Sound Fall Chum
Hood Canal Summer Chum	Hood Canal Summer Chum
West Hood Canal Fall Chum	Hood Canal Fall Chum
Northeast Hood Canal Fall Chum	Hood Canal Fall Chum
Southeast Hood Canal Fall Chum	Hood Canal Fall Chum
Jimmycomelately Summer Chum	Discovery Bay and Sequim Bay Summer Chum
Totten Inlet Fall Chum	Central/South Puget Sound Fall Chum
Pink	
South Fork Nooksack Pink	Nooksack Pink
North Fork/Middle Fork Nooksack Pink	Nooksack Pink

Skagit Pink	North Puget Sound Pink
North Fork Stillaguamish Pink	North Puget Sound Pink
South Fork Stillaguamish Pink	North Puget Sound Pink
Snohomish Even-Year Pink	Snohomish Even-year Pink
Snohomish Odd-Year Pink	North Puget Sound Pink
Puyallup Pink	Puyallup Pink
Nisqually Pink	Nisqually Pink
Hamma Hamma Pink	Hood Canal Pink
Duckabush Pink	Hood Canal Pink
Dosewallips Pink	Hood Canal Pink
Upper Dungeness Pink	Upper Dungeness Summer Pink
Lower Dungeness Pink	Lower Dungeness Fall Pink
Elwha Pink	Lower Dungeness Fall Pink
Steelhead	
Dakota Creek Winter Steelhead	North Puget Sound Steelhead
Mainstem/North Fork Nooksack Winter Steelhead	North Puget Sound Steelhead
South Fork Nooksack Summer Steelhead	North Puget Sound Steelhead
South Fork Nooksack Winter Steelhead	North Puget Sound Steelhead
Middle Fork Nooksack Winter Steelhead	North Puget Sound Steelhead
Samish Winter Steelhead	North Puget Sound Steelhead
Mainstem Skagit/ Tributaries Winter Steelhead	North Puget Sound Steelhead
Finney Creek Summer Steelhead	North Puget Sound Steelhead
Sauk Summer Steelhead	North Puget Sound Steelhead
Sauk Winter Steelhead	North Puget Sound Steelhead
Cascade Summer Steelhead	North Puget Sound Steelhead
Cascade Winter Steelhead	North Puget Sound Steelhead
Stillaguamish Winter Steelhead	North Puget Sound Steelhead
South Fork Stillaguamish Summer Steelhead	North Puget Sound Steelhead
Deer Creek Summer Steelhead	North Puget Sound Steelhead
Canyon Creek (Stillaguamish) Summer Steelhead	North Puget Sound Steelhead
North Fork Skykomish Summer Steelhead	North Puget Sound Steelhead
Snohomish/Skykomish Winter Steelhead	North Puget Sound Steelhead
South Fork Skykomish Summer Steelhead	North Puget Sound Steelhead
Pilchuck Winter Steelhead	North Puget Sound Steelhead
Snoqualmie Winter Steelhead	North Puget Sound Steelhead
Tolt Summer Steelhead	North Puget Sound Steelhead
Lake Washington Winter Steelhead	South Puget Sound Steelhead
Green (Duwamish) Summer Steelhead	South Puget Sound Steelhead
Green (Duwamish) Winter Steelhead	South Puget Sound Steelhead
Mainstem Puyallup Winter Steelhead	South Puget Sound Steelhead
White (Puyallup) Winter Steelhead	South Puget Sound Steelhead
Carbon Winter Steelhead	South Puget Sound Steelhead
Nisqually Winter Steelhead	South Puget Sound Steelhead
Deschutes Winter Steelhead	South Puget Sound Steelhead

Dewatto Winter Steelhead	South Puget Sound Steelhead
Tahuya Winter Steelhead	South Puget Sound Steelhead
Union Winter Steelhead	South Puget Sound Steelhead
Skokomish Summer Steelhead	South Puget Sound Steelhead
Skokomish Winter Steelhead	South Puget Sound Steelhead
Hamma Hamma Winter Steelhead	South Puget Sound Steelhead
Duckabush Summer Steelhead	South Puget Sound Steelhead
Duckabush Winter Steelhead	South Puget Sound Steelhead
Dosewallips Summer Steelhead	South Puget Sound Steelhead
Dosewallips Winter Steelhead	South Puget Sound Steelhead
Quilcene/Dabob Bays Winter Steelhead	South Puget Sound Steelhead
Dungeness Summer Steelhead	South Puget Sound Steelhead
Dungeness Winter Steelhead	South Puget Sound Steelhead
Morse Creek/Independents Winter Steelhead	South Puget Sound Steelhead
Elwha Summer Steelhead	North Coast Steelhead
Elwha Winter Steelhead	North Coast Steelhead
Salt Creek/Independents Winter Steelhead	North Coast Steelhead
Lyre Winter Steelhead	North Coast Steelhead
Pysht/Independents Winter Steelhead	North Coast Steelhead
Clallam Winter Steelhead	North Coast Steelhead
Hoko Winter Steelhead	North Coast Steelhead
Seiku Winter Steelhead	North Coast Steelhead
Sail Winter Steelhead	North Coast Steelhead
Sooes/Waatch Winter Steelhead	North Coast Steelhead
Ozette Winter Steelhead	North Coast Steelhead
Sol Duc Summer Steelhead	North Coast Steelhead
Sol Duc Winter Steelhead	North Coast Steelhead
Quillayute/Bogachiel Winter Steelhead	North Coast Steelhead
Dickey Winter Steelhead	North Coast Steelhead
Bogachiel Summer Steelhead	North Coast Steelhead
Calawah Summer Steelhead	North Coast Steelhead
Calawah Winter Steelhead	North Coast Steelhead
Mosquito Creek Winter Steelhead	North Coast Steelhead
Goodman Creek Winter Steelhead	North Coast Steelhead
Hoh Summer Steelhead	North Coast Steelhead
Hoh Winter Steelhead	North Coast Steelhead
Kalaloch Creek Winter Steelhead	North Coast Steelhead
Queets Summer Steelhead	North Coast Steelhead
Queets Winter Steelhead	North Coast Steelhead
Clearwater Summer Steelhead	North Coast Steelhead
Clearwater Winter Steelhead	North Coast Steelhead
Raft Winter Steelhead	North Coast Steelhead
Quinault Summer Steelhead	North Coast Steelhead
Quinault Winter Steelhead	North Coast Steelhead

Quinault/Lake Quinault Winter Steelhead	North Coast Steelhead
Moclips Winter Steelhead	North Coast Steelhead
Copalis Winter Steelhead	North Coast Steelhead
Humptulips Summer Steelhead	Southwest Washington Coast Steelhead
Humptulips Winter Steelhead	Southwest Washington Coast Steelhead
Hoquiam Winter Steelhead	Southwest Washington Coast Steelhead
Chehalis Summer Steelhead	Southwest Washington Coast Steelhead
Chehalis Winter Steelhead	Southwest Washington Coast Steelhead
Wishkah Winter Steelhead	Southwest Washington Coast Steelhead
Wynoochee Winter Steelhead	Southwest Washington Coast Steelhead
Satsop Winter Steelhead	Southwest Washington Coast Steelhead
South Harbor Winter Steelhead	Southwest Washington Coast Steelhead
Skookumchuck/Newaukum Winter Steelhead	Southwest Washington Coast Steelhead
North/Smith Creek Winter Steelhead	Southwest Washington Coast Steelhead
Willapa Winter Steelhead	Southwest Washington Coast Steelhead
Palix Winter Steelhead	Southwest Washington Coast Steelhead
Nemah Winter Steelhead	Southwest Washington Coast Steelhead
Naselle Winter Steelhead	Southwest Washington Coast Steelhead
Bear Winter Steelhead	Southwest Washington Coast Steelhead
Grays Winter Steelhead	Southwest Washington Coast Steelhead
Skamokawa Creek Winter Steelhead	Southwest Washington Coast Steelhead
Elochoman Winter Steelhead	Southwest Washington Coast Steelhead
Mill Creek Winter Steelhead	Southwest Washington Coast Steelhead
Abernathy Creek Winter Steelhead	Southwest Washington Coast Steelhead
Germany Creek Winter Steelhead	Southwest Washington Coast Steelhead
Case/Carr Inlets Winter Steelhead	South Puget Sound Steelhead
Discovery Bay Winter Steelhead	South Puget Sound Steelhead
Eld Inlet Winter Steelhead	South Puget Sound Steelhead
Hammersley Inlet Winter Steelhead	South Puget Sound Steelhead
Sequim Bay Winter Steelhead	South Puget Sound Steelhead
Totten Inlet Winter Steelhead	South Puget Sound Steelhead
East Kitsap Winter Steelhead	South Puget Sound Steelhead

Appendix B: Nooksack Tribe Full Response

Nooksack Indian Tribe
Natural Resources Department

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Feb. 18, 2003

Lars Mobrand-Chair
Hatchery Scientific Review Group
c/o Long Live the Kings
1305 Fourth Ave. Suite 810
Seattle, WA. 98101

Re: Manager Response to North Puget Sound Hatchery Reform Recommendations

The purpose of this letter is to provide managers response to the Jan. 10, 2003 draft HSRG Nooksack/Samish recommendations. The HSRG has spent considerable time reviewing these programs, and we appreciate your efforts to help recovery and conserve naturally spawning populations and supporting sustainable fisheries. We believe most of the recommendations make sense, and will aid us in providing for harvest, while recovering salmon.

We must say, however, that we are disappointed with the recommendation to include a trap with a ladder, if built, on the Middle Fork "to increase management options" while restoring passage for ESA listed North/Middle Fork spring chinook, and listed bull trout, as well as for steelhead and coho. Our concerns are for impacts to ESA listed fish when holding, handling, and sampling them, for costs to test and man any trap, and for logistics (for example even accessing the site during winter weather), and for excluding wild salmon and trout from their habitat. This recommendation is included within the Kendall North/Middle Fork chinook and steelhead program reviews as well as the Lake Whatcom kokanee program reviews. The Lake Whatcom kokanee program comments even mention a possible action of denying upstream passage of salmonids by use of this trap, if they prove positive for reportable pathogens. In our consensus WDFW/Lummi Nation/Nooksack Tribe response to this which was previously sent to the HSRG, we stated that we disagreed with this scenario. We will repeat a portion of the response, and the reasons why this option, when we evaluated it, was rejected by co-managers.

Joint co-manager response: *Disagree. Incidental observations in recent years have documented adult salmon or trout jumping at, or over, the diversion dam from early May through early November. This reflects the prolonged adult migration and holding periodicities of the chinook, bull trout, coho, and steelhead which will utilize the 17+ miles of former habitat. The ½ mile gorge downstream from the diversion dam (where at its narrowest, the entire river is squeezed through a 9 foot wide bedrock channel) will restrict use by weaker swimmers (chum, most pinks). We believe stronger swimming salmon and trout species will need passage all year, when flow conditions are relatively low. A recommendation to restrict passage to certain times of the year conflicts with our*

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salmon recovery efforts. While ladder design may accommodate a trap, costs, logistics, and concerns on potential impacts to ESA listed chinook and bull trout, through handling and sampling individual fish, resulted in co-manager rejection of a trap, test and hold scenario.

We understand that the HSRG does not have time to fully flesh out pros and cons of options, but we do note that there is no discussion of how the concerns we conveyed to the HSRG would be adequately addressed. We also want to point out that in 2002 the wild North/Middle Fork early chinook escapement was 221, while kokanee creek spawners numbered approximately 20,000. Additionally, at our last joint co-manager meeting with the City of Bellingham and the Army Corps of Engineers on funding for restoring/greatly improving anadromous use to Middle Fork, we discussed a potential option to remove the diversion dam, instead re-designing the intake structure as a cheaper and more desirable solution. Fish ladders rarely work as well as intended, and we believe this option, if feasible, would be more beneficial for Chinook and bull trout recovery than building a ladder.

While we do not have a hatchery our fishermen benefit from hatchery programs, and along with WDFW and the Lummi Nation we have put considerable energy into evaluating and adaptively managing the Kendall early chinook program. Through this we have learned how much effort and cost it takes to really accomplish adaptive management, through data collection (for example collecting otoliths, DNA, and coded wire tags on spawning grounds), analyzing the results, interpreting the data, and adjusting the program. We believe the evaluation for this program provides insight for the effort it will take to meet hatchery reform obligations for many more programs in the future. Indeed, many of your recommendations will require a similar commitment of resources. We encourage the HSRG to more clearly emphasize the need to provide adequate funding for this. Many of your program recommendations are sound, but will require substantial resources to effectively implement.

Thank you for providing the opportunity for comments.

Sincerely,

Robert Kelly
Director

Appendix C: South Sound Spring Chinook Technical Committee Comments on White River Spring Chinook

Comments provided to HSRG, 12/17/02.

At the November 20, 2002 South Sound Spring Chinook Technical Committee meeting, there was unanimous agreement with the first two recommendations regarding the White River spring chinook recovery program.

The first recommendation has already been addressed by the South Sound Spring Chinook Technical Committee (representing WDFW, Muckleshoot Fisheries, Puyallup Fisheries, US Forest Service and NMFS). As a matter of logistical efficiencies, the Technical Committee has come to the conclusion that NOR incorporation should begin in the fall of 2004. At that point in time, all Puyallup basin hatchery chinook production (including acclimation pond production) will be either marked or tagged and will be readily identified at WRH and the Buckley trap. That will leave only spring and fall NORs to consider for incorporation. The technical committee is considering taking appropriate numbers of NORs to WRH, take a non-lethal tissue sample, identify the spring chinook by in-season DNA microsatellite analysis for broodstock and haul any fall chinook NORs above Mud Mountain Dam. This protocol (not formalized at this point in time) has met with general approval from NOAA Fisheries consultants.

The second recommendation to stock a representative sample of the run into the acclimation ponds is a commendable objective, however, it may be logistically difficult to accomplish. There are problems associated with rearing fish from temporally divergent egg takes, so that they are the same size at transfer, minimizing size-related rearing differences in the pond populations. Also, it may be difficult to get late fish to size at an appropriate transfer time.

There was universal opposition on the Technical Committee to the third recommendation, the proposed elimination of the Hupp Springs component of the integrated recovery program. I would expect that there will be multiple negative "Manager Responses" to this recommendation, including my own.

In the Committee's 1996 Recovery Plan (p. 63), the threshold for discontinuing Hupp Springs production support is after 1,000 untagged spring chinook are passed upstream in three of four consecutive years. The ultimate concern is that there be some evidence that the in-basin program is capable of maintaining

progress toward recovery without Hupp support. Note that 1,000 springs are specified in the recovery goals (p.49). The Technical Committee does not think that we have adequate data in hand to develop an analysis of whether the threshold criterion has been met (e.g. what proportion of recent escapements are spring chinook) or whether the in-basin program can currently support stock recovery independent of Hupp. The committee is not ready to abandon the tenets of the recovery plan and, at the last meeting, Tim Tynan of NOAA Fisheries stated that the Science Center is not ready to acknowledge that the Hupp Springs program is not necessary for recovery.

Also, since the November meeting, Bill Graeber of the NOAA Fisheries Chinook Technical Review Team contacted the Technical Committee questioning the advisability of this action. It was his opinion that the recommendation was premature in two regards. The first is that we do not "know where we are on the White River spawning and rearing habitat recovery curve," so what is the basis of expectation that the stock recovery can be maintained, at this point in time, with only the in-basin program? Secondly, he wanted to point out the potential negative impacts that premature elimination of Hupp Springs production may have on basin watershed planning and management processes. He believes that we will be sending the message that we have arrived at some stage of recovery and that motivation for more responsible watershed management will be reduced when, in fact, we do not know how far we have progressed toward stock recovery.

Additionally, there is a longer-term harvest objective associated with the White River chinook program (1996 recovery plan, p. 49). There is a significant link between Hupp Springs production and that objective. The Technical Committee, until further study indicates otherwise, is operating under the precept that maximizing the acclimation pond production is critical to achieving the escapement threshold and subsequent harvest opportunities. As noted in the "Operational Considerations" and in the comment in the first paragraph regarding that section, Hupp Springs plays a major part in the implementation of the acclimation program. The Technical Committee is currently in the process of evaluating the contribution of the acclimation production to the upriver escapement and its distribution throughout the Puyallup/White River basin and thinks that the elimination of the Hupp program, before this assessment is complete, is premature.

The committee recognizes HSRG's desire to have the recovery program driven predominantly by White River basin-origin fish, allowing the population to

expediently adapt to the indigenous environment. However, the committee thinks, given the paucity of evidence suggesting genetic drift between the two hatchery broodstocks and the lack of any quantitative demonstration that the White River origin broodstock exhibits differential, beneficial behavioral traits, that the short term risk associated with maintaining the Hupp Springs program until the acclimation pond impacts are discerned, is minimal.

The statement under "Benefits and Risks" that "Gene flow between the Hupp Springs program and the White River Hatchery is in one direction only - from Hupp Springs to the White River" is historically correct, but not currently. In spite of Shaklee and Young's opinion that "...the marginally significant uncorrected test results and the non-significant corrected test results are hardly convincing evidence for substantial genetic differentiation between the two populations" and that, given the history of these programs, "...it seems illogical to conclude that the observed difference between the two collections (whether statistically significant or not) can or should be explained by genetic drift or selective differences between the two populations," broodstock contribution from White River Hatchery to Hupp Springs was instituted this year. A five percent contribution of White River Hatchery males was made to the Hupp Springs production to address *potential, unsubstantiated* genetic drift between the two broodstocks. I think the Technical Committee would be amenable to maintenance of this program, as well as NOR incorporation into the Hupp Springs broodstock, in order to moderate HSRG concerns regarding the suitability of that broodstock for White River recovery efforts.

Finally, implementation of this recommendation may have a much broader impact on the recovery program. Hupp Springs is specifically a WDFW production program and is one of that agency's primary contributions to the recovery effort. If WDFW complied with this recommendation in spite of their objections, it could be viewed by the other participants that WDFW unilaterally abandoned the agreed-to recovery plan and that the entire burden of recovery would fall on those other agencies. I think that a very carefully fostered cooperative recovery effort could be seriously hampered by the implementation of this recommendation.